PROCEEDINGS

Sixty-First Annual Convention

OF THE

American Railway Bridge & Building Association

1956

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Proceedings of the

Sixty-first Annual Convention

of the

American Railway
Bridge & Building
Association

Held at

CHICAGO, ILLINOIS

September 18-20, 1956

Published by the Association
Elise LaChance, Secretary
431 So. Dearborn St., Chicago 5

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Chicago & North Western, Chicago

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T. M. von Sprecken, Southern ..... Washington, D. C.
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Past President

J. A. Jorlett, Pennsylvania ..... Baltimore, Md.

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PROCEEDINGS

The Event—The 61st Annual Convention of the Bridge & Building Association
The Time—September 18-20, 1956
The Place—The Conrad Hilton Hotel, Chicago

Following the custom of many years' standing, the Bridge & Building group held their meetings concurrently, although separately from the Roadmasters and Maintenance of Way Association.

Attendance at the two conventions broke all records. Total registration amounted to 1765, including 616 guests and 1149 railroad members.

A manufacturers' exhibit held in connection with these two conventions also broke all existing records, with a total of 276 booths being occupied.

Those present at the B& B meetings heard many interesting and informative addresses, which are presented on the following pages.

Joint Opening Session

The opening joint session convened at 10:00 a.m. on Tuesday, September 18. During this session members of both groups heard major addresses by J. P. Newell, vice-president, Pennsylvania, and R. J. Stone, vice-president, operations, Frisco.

Separate Session of B&B Association

President J. A. Jorlett presided over the separate sessions, which consisted primarily of the presentation of six committee reports. They are as follows: Coach Watering Facilities Must Be Sanitary; The Supervisor—His Records, Accounts and Cost Information; Moving the B& B and Water Service Gang Over the Highway; Prefabricated Buildings Versus Other Types of Construction; Advancements in Protective Coating Systems for Railway Structures; and The Slow Order and Bridge Maintenance and Renewals.

Remarks by President J. A. Jorlett

Mr. Jorlett began his opening address by pointing out the careful analysis, thought and investigation that go into the selection of your committee reports every year. As he put it—

"The object of this association as stated in our constitution is to advance the knowledge pertaining to the design, construction and maintenance of railway bridges, buildings, water service facilities and other structures; by investigation, reports and discussions."

Mr. Jorlett continued along this line by saying that a major portion of our revenues are used to prepare the reports and incorporate them in our Annual Proceedings for your permanent reference and review. He also asked for comments members may wish to make about these reports which might be included in a future Proceedings.

He then went on to say that membership is another important facet of our organization. In addition to urging that new members be brought into the group, he also stated that when losing our old members, we must strive to find the reason why they have lost interest and faith in our organization and how we have failed them.

Mr. Jorlett turned again to the Proceedings, soliciting the co-operation of all members in devoting their attention to the advertisements contained in the book since the messages they convey may be of beneficial help to all.

"In closing my remarks," Mr. Jorlett said, "I would state that the foregoing is like a golden thread woven throughout the fabric of our organization. We are a service organization. What we are trying to shape is a philosophy for bridge and building men to make a place for themselves in the railroad industry and what all maintenance of way forces should do to strengthen the railroad system under which we function. The American Railway Bridge & Building Association has taught me how to go about doing something with this philosophy. I am grateful to my management for making it possible for me to attend these meetings and interchange with you, your own ideas and principles and practices of your managements. Your board has a sense of these values and a sense of their direction. It has been a singular pleasure to work for them and with them and with all of you. Thank you from the bottom of my heart."

The new subjects selected, on which committee reports will be based and presented at the 1957 convention are as follows:

Branch Line Bridges & Buildings and Their Maintenance
Let the Motto Be: Always Safety First
Utilities of Ready Mix, Precast, and Prestressed Concrete in B&B Work
Maintenance of Automotive and M/W Work Equipment
Problem in Maintenance of Motion Weighing Track Scales
What Should the Supervisor Expect from Management and Vice Versa
Mechanization, Tools & Equipment

The following officers were elected to direct the affairs of this association during the coming year: President—R. R. Gunderson, engineer maintenance of way, Western Maryland, Baltimore, Md.; first vice-president—W. H. Huffman, assistant engineer maintenance of way, Chicago & North Western, Chicago; second vice-president—M. H. Dick, editor, Railway Track & Structures, Chicago; third vice-president — B. M. Stephens, assistant to executive vice-president, Southern Pacific Lines, Houston, Tex.; and fourth vice-president—H. D. Curie, master carpenter, B&O, Garrett, Ind. L. C. Winkelhaus, architectural engineer (retired), North Western, Chicago, was re-elected treasurer.

New directors are: J. M. Lowry, chief engineer, Cotton Belt, Tyler, Tex. (re-elected); T. M. von Sprecken, assistant to chief engineer, Southern, Washington, D. C.; and H. A. Matthews, gen. fore. b. & b., Frisco, Amory, Miss.

SECRETARY'S REPORT
of
MEMBERSHIP AS OF SEPTEMBER 16, 1956

Total Active Members—September 15, 1955			503
New Active Members since September 15, 1955			62
Total			565
Less—Reported Deceased	2		
Resigned a/c retirement, etc.	13		
Elected to Life Membership	8		
Elected to Honorary Membership	1		
Dropped a/c DNPD (1954)	31		
Dropped a/c mail returned	3	58	
Total Active Members			507
Total Associate Members—September 15, 1955			87
New Associate Members since September 15, 1955			11
			98
Less—Reported Deceased	3		
Resigned	10		
Dropped a/c DNPD (1954)	13	26	
Total Associate Members			72
Total Life Members—September 15, 1955			71
Elected to Life Membership			8
			79
Less—Reported Deceased	6		
Dropped a/c mail returned	4	10	
Total Life Members			69
Total Honorary Members—September 15, 1955			8
Elected to Honorary Membership—September 15			1
Total Honorary Members			9
Total Membership—All Classes			657

REPORT OF THE NECROLOGY COMMITTEE

TO THE PRESIDENT AND MEMBERS OF THE AMERICAN RAILWAY BRIDGE & BUILDING ASSOCIATION:

We regret to advise that we have learned of the loss of eleven (11) members through death during the year. It is possible that other members have passed away during the year, of which we have no information. If you know of any, we would like to have their names. The following have been reported:

NAME	TITLE-RAILROAD	JOINED	DIED
Active Members			
R. F. Cook	B&B Supervisor Illinois Central Vicksburg, Miss.	1954	Oct. 9, 1955
O. W. Stephens	Engineer Maint. of Way Delaware and Hudson Albany, N.Y.	1929	March 10, 1956
Associate Members			
E. F. Cottier	Salesman, Pacific Coast Borax Co. Auburn, Ala.	1953	Aug. 5, 1956
H. Montgomery	District Manager The Master Builders Co. Los Angeles, Calif.	1946	1955
Barton S. Snow	President, T. W. Snow Const. Co. Batavia, Ill.	1946	Dec., 1955
Life Members			
S. T. Corey (Ret.)	Engr. of Bridges Rock Island Chicago, Ill.	1913	Jan. 21, 1954
W. T. Lacy (Ret.)	Supervisor B&B Missouri Pacific St. Louis, Mo.	1911	Jan. 7, 1955
E. M. McCabe (Ret.)	Supervisor B&B Boston and Albany New Smyrna Beach, Fla.	1915	Oct. 18, 1955
H. C. McNaughton (Ret.)	Supervisor B&B, Boston and Maine Greenfield, Mass.	1915	June, 1955
H. VanSchrenk (Ret.)	Constr. Timb. Engr., Dela., Lackawanna & West. St. Louis, Mo.	1916	1953
H. Wuerth (Ret.)	Division Engineer Milwaukee Road Savanna, Ill.	1919	Aug., 1956

We deeply regret the passing of these—our fellow members. May we stand a moment in silence to honor these departed members.

Respectfully submitted,

J. F. WARRENFELLS, *Chairman*
H. D. CURIE
Necrology Committee

TREASURER'S REPORT
SEPTEMBER 1, 1955 TO AUGUST 31, 1956

Cash Balance—September 1, 1955		$1,945.06
RECEIPTS:		
Dues	$3,945.60	
Advertising:		
1954 Proceedings	1,967.95	
1955 Proceedings	1,660.00	
Refund from Roadmasters Association for Ladies Luncheon—1955 Convention	142.45	7,716.00
Total Receipts		$9,661.06
DISBURSEMENTS:		
Salaries (Secretary and Clerk)	$1,490.56	
Social Security and Withholding Tax	297.98	
Stationery and Printing	597.22	
Proceedings (1955 Edition)	2,194.91	
Office Supplies	41.47	
Postage	192.31	
Office Rent and Telephone	364.83	
1955 Convention Expense	700.60	
Miscellaneous	74.26	
Office Equipment	30.73	5,984.87
Cash on Hand (August 31, 1956)		$3,676.19
BALANCE:		
First National Bank of Chicago, August 31, 1956		$3,813.89
Less—Outstanding Checks		137.70
		$3,676.19

L. C. WINKELHAUS,
Treasurer

September 12, 1956
APPROVED:
R. C. BAKER, Chairman
R. E. DOVE
Auditing Committee

MR. PRESIDENT AND FELLOW MEMBERS:

The American Railway Bridge & Building Association, in convention assembled, recognizing that the special efforts of certain parties should be fittingly acknowledged, does hereby recommend the following resolutions, to wit:

Be it resolved that the appreciation of the officers, members and guests of this Association be expressed to the management and personnel of the Conrad Hilton Hotel for the co-operation and hospitality we have enjoyed.

Be it further resolved that the sincere thanks of the officers and members of this Association be extended to the Simmons-Boardman Publishing Corporation and its representatives. Their assistance and interest have been invaluable.

Be it further resolved that the sincere appreciation and thanks of the officers, members and guests of this Association be extended to the officers and members of the Bridge and Building Supply Men's Association and to the Track Supply Association. Their untiring and devoted support of our Association at the convention and throughout the year is a vital factor in the success of our efforts. The outstanding exhibit at the Coliseum and the banquet helped immeasurably to assure the success of our convention.

Be it further resolved that the appreciation and thanks of the officers, members and guests of this Association be extended to:

Mr. J. P. Newell, Vice President, Pennsylvania Railroad;

Mr. R. J. Stone, Vice President-Operations-St. Louis-San Francisco Railroad;

Mr. P. J. Calza, Engineer Water Service, Chicago, Rock Island & Pacific Railway;

Dr. Joseph A. Bigos, Director of Research, Steel Structures Painting Council for the interesting and informative addresses they have presented before our meetings.

Your Resolutions Committee recommends that these resolves be spread upon the Minutes of the Convention so that they become a part of our Annual Proceedings and that copies of these resolves be forwarded to the parties concerned.

M. H. DICK, *Chairman*

H. M. HARLOW,
Resolutions Committee

REPORT OF AUDITING COMMITTEE

TO MEMBERS OF THE
AMERICAN RAILWAY BRIDGE & BUILDING ASSOCIATION:

Gentlemen:

The undersigned have examined the books of the Secretary and report of the Treasurer for the period from September 1, 1955 to August 31, 1956, inclusive, and have found them to be correct as of the latter date.

Respectfully submitted,

R. C. BAKER, *Chairman*
R. E. DOVE, *Auditing Committee*

September, 1956

Presented Below Are Two Major Addresses by Messrs. Calza & Bigos Which Were Delivered Before the Separate Sessions of the Bridge & Building Association

On Tuesday, September 18, Mr. P. J. Calza, engineer water service of the Rock Island at Chicago, whose address was entitled "Why We Organized a Composite Water Service—B&B Gang" had the following comments to make.

It is an honor and privilege to appear before you today to describe to you an experiment underway on the Rock Island Railroad designed to do more work more efficiently with our own men.

(A) Why Gang Was Organized

As the result of many months of study by the management of the Rock Island Railroad and the Brotherhood of Maintenance of Way Employees a new type of construction gang known as the Composite Bridge & Building-Water Service Gang was organized. This gang was set up on an experimental basis of one year to undertake construction projects of various types which the Railroad had previously let out to private contractors.

In the past, whenever large and extensive construction, remodeling, or maintenance work on bridges and buildings was undertaken that required specialized personnel the Rock Island felt it necessary to call on private contractors to do the work. During the period of dieselization on the Rock Island which was completed at the end of 1953, a large number of shop terminals were dismantled or remodeled and new facilities for servicing diesels were constructed. This included prefabricated steel diesel houses, service buildings, washrooms, fueling stations, watering and sanding stations, wash racks, inspection pits, etc. Due to the management's objective to have the entire Rock Island System dieselized by 1953, it was necessary to contract a large amount of the dieselization work and bridge work during this period, as much of the work required specialized craftsmen.

The increase in the number of projects being contracted brought objections from the Brotherhood of Maintenance of Way Employees, who contended that in some cases the Railroad was contracting the work unnecessarily, and that the regular B&B and Water Service employees, if furnished proper tools and equipment, could be used to a greater extent.

Agreement to end numerous disputes and claims became possible when the Railroad

management agreed with the Organization's representatives to try to develop specialists from the ranks of the present B&B and Water Service employees. During the studies it became apparent that both parties must work together in order to:

1. Develop capable specialists among present railroad employees, by furnishing instructions from qualified specialists;

2. Equip them with the necessary modern tools and equipment; and

3. Thus enable the carrier to do its own work for less cost.

The gang was set up on a system basis operating similar to a contractors crew, doing an entire job without having to call in outside craftsmen. In building work the gang was set up to engage in such tasks as setting reinforcing steel, concrete work and finishing, concrete block laying, lathing, plastering, masonry work, carpentry work (both rough and finish), glazing, roofing, flooring, cabinet work and painting; the gang will also perform all plumbing, heating, ventilating, steam fitting, and miscellaneous piping encountered in building work. In connection with bridge work the gang will be called on to do coffer dam work, driving of foundation piling, and heavy masonry or concrete work involved in construction or rehabilitation of piers, abutments, and wing walls. This gang will not, however, attempt any electrical work, except roughing in conduit, nor will it engage in timber trestle and steel bridge erection or maintenance.

(B) Selection of Men

After considerable study to obtain a well balanced construction gang the organization was set up for a Foreman, an Assistant Foreman and nine composite mechanics. Seven of the mechanics were selected from the B&B roster and two from the Water Service. The Foreman and Assistant Foreman were selected on the basis of experience, past performance, leadership, and ability to organize and supervise. Another consideration in selecting the Foreman was to secure a man well versed in railroad operation and methods who could co-ordinate his work with various problems arising with train operations.

As a preliminary step in organizing the crew nearly all gangs in the B&B and Water Service department throughout the system were personally contacted, explaining to the men the nature and purpose of the gang and also the desired qualifications for its members. Special bid bulletins were sent to all B&B and Water Service men requesting bids for the available positions, with the bidders tabulating the crafts in which he was most proficient. Although seniority was an important consideration in the final selection of the men, there were many other factors to be considered. There was first the fact of selecting men according to their skill and proficiency in a variety of crafts. Another very important consideration was to select men who would get along with one another and not cause trouble either on the job or in the living quarters. Before making the final selection of the gang complete information concerning the individuals picked was secured from local supervisors who had been closely associated with them.

As an inducement to secure the best men possible from the B&B and Water Service rosters, and as the gang was to operate over the entire system, the hourly wage rate was set slightly higher than the highest rate paid either craft who work on the regular gangs.

The mechanics on this gang are not limited to any particular craft and do whatever work assigned to them by the Foreman, whether it be digging a ditch, plumbers work, or carpentry. Being able to use the mechanics on this basis gives the gang flexibility and capacity to do more work than if you were limited as to what each mechanic could do. Employees assigned to this group establish a seniority date in the new group, however, they retain and continue to accumulate seniority in their respective home territory groups.

The Foreman is indirectly responsible to the Chief Engineer, but reports directly to the Division Engineer and District Bridge Supervisor on whose territory he is located.

(C) Bunk & Tool Cars

Considering that this was to be a system gang which would have to make long runs when going to a new job, the bunk cars and tool cars selected were in good mechanical condition so the entire outfit could be moved on the fastest freights and anywhere in the train. Also considering that this was to be a system gang with men required to spend much of their time away from home, every effort was made to give them the best possible living and working quarters.

Two 50 ft. auto boxes were transferred from commercial service, reconditioned and converted into tool and material cars. Auto boxcars were selected in order to secure the larger door openings required for the large

pieces of work equipment assigned to this gang. One end of both tool cars has built in permanent tool racks, the top of which serves as a work bench, along each side with a 3 ft. aisle running down the center. The other end of the tool cars is reserved for storage of the large equipment and bulky construction materials. An electric light circuit with lights along the ceiling and convenient electrical outlets at work bench height were also installed in the tool cars. A 40 ft. flat car: reconditioned, redecked, and with permanent blocking for the truck crane is also assigned to the gang.

An 80 ft. tourist Pullman was selected to serve as a combination cook, bunk, and office car dividing it into 3 separate rooms, as follows:

1. The Kitchen - Dining - Recreation room which occupies 20 ft. in one end of the car;
2. The bunk room which occupies 37½ ft. in the center of the car; and
3. The office room which occupies 16 ft. in the other end of the car and also serves as living quarters for the Foreman and Assistant Foreman.

The kitchen is completely modern with a 10 cubic ft. Servel gas refrigerator, a 40 gallon automatic gas hot water heater, a large 4 burner gas cooking stove with oven, and a 20,000 B.T.U. gas heater all operating on propane gas supplied from tanks located in the vestibule of the car. A 10 foot fixed table with benches, and various built in cabinets and shelves completes the kitchen which is also used as the recreation area after the meals are over. A complete complement of new cooking and eating utensils is also provided. The men take turns with the cooking and immediately after every meal the entire gang pitches in and the kitchen is cleaned up, including all the dishes, in about 15 minutes. The cost of food is equally divided among the men, which averages about 55 cents per meal.

The bunk room contains 5 double bunk beds with innerspring Pullman mattresses on each bunk, 10 individual steel clothes lockers each 18" x 21", and the washing facilities in one end of the room. The washing facilities includes two standard metal shower cabinets and 4 lavatories.

The office room contains an office desk, a file cabinet, 1 double bunk, 2 steel lockers and a closet where expensive small tools and equipment are kept. This room has a small washroom with lavatory and toilet. The toilet was installed to be used only when the car is moving.

The bunk car was completely rewired using exposed conduit with lights and outlets conveniently located throughout the car and service entrances at each end of the car. The domestic water supply consists of a connection on one side of the car just under the floor where city water is brought in under pressure through 2 overhead tanks and distributed throughout the car. The overhead tanks always remain full and furnish a water supply while the car is moving. The car is heated with two 50,000 B.T.U. oil stoves, with the oil supply tank of 100 gallon capacity strapped to the underside of the car. Ventilation for the car is provided by three 20 inch reversible exhaust window fans located in each room.

The estimated cost of all labor, material, and equipment used to convert the bunk car, 2 tool cars and flat car is $5800.

(D) Equipment

After considerable thought was given to the tools and equipment that would be needed to enable the gang to perform economically the various types of work to which it would be assigned, it was decided to purchase the entire complement of tools and equipment needed and assign it to the gang, thus eliminating any delay to the gang which may have resulted from drawing the necessary equipment from the roads equipment pool. Approximately $31,600 was spent for the needed equipment, the principal units being as follows:

6 Ton Truck Crane with 25 ft. boom; ⅜ C.Y. dragbucket and ⅜ C.Y. clamshell; 1½ ton flat bed truck with power wench; ½ ton pick-up truck; 2 sack concrete mixer on pneumatic tires; ½ yard concrete bucket; set wheelbarrow platform scales; set portable steel scaffolding with 1200 sq. ft. of area; 80 gallon roofers kettle with pneumatic tires; assortment ladders and telescopic scaffolds; 125 C.F.M. rotary gasoline driven air compressor with pneumatic tires; air demolition tools; air rock drill medium size; air hand drill with assorted tools; 3000 watt electric generator; 26" gasoline powered power trowel; 36" electric chain saw; 10" electric circular saw; ⅝" electric drill; ½" electric drill; electric concrete vibrator; 3" electric belt sander; electric router and planer;

7/8" electric impact wrench; 1 1/8 electric hammer with drills; 10" electric bench saw; 6" electric bench planer; 6" electric bench grinder; adjustable miter box; 2" gasoline driven sump pump; electric pipe threading machine; 20 ton bridge jacks; and complete set of plumber and pipe fitting tools to handle all pipe up to 4 inches.

Besides these units the gang was supplied with all types of hand tools normally required for various types of work to which it would be assigned, except those tools ordinarily furnished by the men themselves.

As part of his duties, the assistant foreman supervises the general care and maintenance of all the tools and equipment. Three members with chauffeurs licenses are assigned to drive the 1 1/2 ton truck, the 1/2 ton pickup, and the truck crane. The man selected to operate the truck crane was trained by a factory representative in the care and operation of the machine.

Whenever a job requires heavier equipment such as bulldozers, pile drivers, large cranes, etc., they are drawn from the roads heavy work equipment pool which also furnishes a qualified operator with the machine. Special items such as large concrete batching bins, and prefabricated concrete forms, are rented when needed.

(E) Instructions

Under the labor agreement on-the-job training is an important consideration. The railroad has carried on classes of instructions from time to time on various phases of work. Classes have been held in the design and handling of reinforced concrete, corrugated metal drainage installations, and the use of prefabricated forms for concrete. On the job training by a skilled craftsman has been furnished for hot mop roof application, concrete block laying, erection of prefabricated forms, concrete floor finishing, and erection of prefabricated steel buildings. For each power tool purchased, a factory representative has demonstrated to the gang operating and maintenance techniques.

A small library in the bunk car is supplied with various books written in simple language and well illustrated to show clearly all types of work to be undertaken. An engineer's level, transit, and rods are assigned to the gang and several members have been instructed as to their use.

(F) Work Accomplished to Date

The construction of a new 50 foot track scale at Kansas City, Kansas was the first task assigned to the newly organized gang. Work was started Aug. 15, 1955 and completed Sept. 9 in 19 working days.

Work on a combination freight and passenger station at Goodland, Kansas was the next assignment. This assignment was considered to be a good test as to the versatility of the gang. This structure a one story concrete block building with concrete floors consisted of a 31' x 44' office section, a 22' x 48' freight room with raised floor, and a 16' x 74' raised platform. The office section contained 2 offices, waiting room, 3 restrooms and heated by under floor perimeter hot air heating. The entire task from excavation to final finishing including bringing in services and 600 ft. of sewer was accomplished in good time. Work on the Goodland depot was started Sept. 12 and completed Dec. 31, 1955 in 81 working days.

On January 2, 1956 work was started on heavy rehabilitation of two wing type concrete bridge abutments at Bridge 5921 at Nara Visa, New Mexico. The work involved installation of false work beams, removal of the entire backwalls above the bridge seats, raising the girder 1 foot, constructing new concrete backwalls and placing an 8" reinforced concrete jacket over the abutment faces, each of which were 16' high with 32 ft. wing walls on each side. This was a challenging project due to the high fills, sandy soil conditions, and cold weather, however, the work was completed March 16 in 56 working days.

The next 2 jobs undertaken were the installation of multi-plate culverts under existing bridges at 2 locations near Concho and Ryan, Oklahoma. These 2 culverts a 108"x 66' and 120"x52' multi-plate pipe were completed in 13 working days.

On April 9, 1956 excavation was started at Blue Island, Illinois for the construction of a 55'x80' insulated prefabricated steel building set on a concrete slab to be used as an office and wash and locker room to serve 180 shop employees. Plumbing and piping was very heavy in this building which also included running a 1000 ft. of 4" cast iron water main all located about 3 ft. below the ground water table. No particular difficulties were encountered in this construction. All work involved in this project including installation of a hot water heating system was completed June 29 in 60 working days.

The Composite B&B Water Service Gang is presently engaged in a major bridge project at Meade, Kansas which is the largest project yet undertaken.

Work at Bridge 3898 consists of removing an existing concrete bank block, construction of two new high concrete piers, and one new bank block in order to extend the existing bridge with two 70 ft. steel girder spans. A few of the construction quantities involved are as follows:

6000 C.Y. of fill excavation under existing falsework at piers and abutment locations; 2760 Lin. Ft. of 14" Armco pipe foundation piling; 1440 Lin. Ft. of creosote foundation piling; and 400 Cu. Yds. of reinforced concrete.

This work is progressing satisfactorily and all the concrete work should be completed about Nov. 15.

(G) Conclusion

A comparison of actual unit costs with those of similar previous jobs indicate that the costs are about the same as those secured from contractors, however, this comparison was made on the Goodland, Kansas depot when the gang was relatively new and still inexperienced. The quality of work being performed is comparable to work of most contractors. The men have shown a real interest in the performance of their work, and are satisfied with the working conditions. The turnover has been satisfactory as only 3 men out of the original group have left the gang.

The experimental period which expired Aug. 15, 1956 has been extended to the end of the year so a better appraisal of the accomplishment of this gang can be made. If the experiment proves successful, as present indications show it will, there will probably be more of these composite gangs established.

Discussion

A member raised the question if ready-mixed concrete would be used if available and Mr. Calza said yes.

J. A. Jorlett (PRR) asked why these gangs did not do any steel erection, and Mr. Calza replied that they have system gangs for doing that work. Also, he said, the electrical work is done by the electrical men of the mechanical department.

H. A. Matthews (Frisco) asked if the Rock Island had had any trouble with the craft unions. Mr. Calza replied he had not because an agreement had been worked out before hand with the Brotherhoods. Mr. Matthews then asked if the system men could ever bid in again on their home-division jobs, to which Mr. Calza replied that they could. Mr. Matthews then raised the question if there were enough big jobs to keep the specialized gangs working, and Mr. Calza replied that there were. He pointed out further that all the men get paid the same rate so that they can do all types of work, covered by a new agreement with the unions. He stated that the water service and bridge men now belonged to the same brotherhood of maintenance of way employees on his road.

J. S. Hancock (DT&I) asked who ordered the material for these gangs and Mr. Calza stated that the heavy material is ordered by the bridge engineer, or the building engineer, whereas he himself orders the smaller items needed. The road establishes credit at local lumber yards so that the men can get lumber quickly whenever they needed it.

T. M. von Sprecken (Sou.) asked who did the cooking for the men in these gangs, and Mr. Calza replied that one man generally turns out to be a better cook than the others, and he is elected to do this work. He leaves his work about 11 o'clock in the morning in order to get lunch and at 4 o'clock in the afternoon for preparing dinner, he said.

Remarks by Dr. Bigos

On Wednesday, September 19, Dr. J. A. Bigos, director of research of the Steel Structures Painting Council at Pittsburgh spoke on the "Painting of Railway Bridges and Buildings." His remarks are as follows:

Painting costs money. We here have two interests in common—an interest in painting and an interest in money. For years, the Steel Structures Painting Council has been trying to reduce the *prohibitive* costs of painting structures and *everyone* here has that same primary interest. We all want to save money. The other interest we share is painting. Here we may differ. I like painting but suspect others in the audience don't like painting.

One fact stands out in my work with structural paints. Whether it is the railway industry, the chemical industry, the maritime industry or other industry, painting is a step-child if not an outright orphan. Many reasons exist for the dislike of painting. At the risk of offending many people, I would say that ignorance of proper painting pro-

cedures is the primary cause for the poor results and poor attitudes towards painting. Certainly, there are many jobs more obnoxious than painting on the railroads. Why then does the attitude of dislike exist towards painting? The answer I believe is due to the fact that most railroad personnel feel that painting is a waste of money. In the past, much of the painting that has been done has been a waste of money. Today, there is no excuse for poor painting practices.

From the outset I wish to make the emphatic statement that *painting can be economical!*

Some painting still being done on many railroads at present is not necessarily economical. Many railroads have gone into studies of painting and established economical painting programs by improvement in practices. Improvement in results on those railroads has brought about a change in attitude towards painting. In this connection, I feel that the mechanical departments of the railroads are far exceeding other branches in their appreciation of the requirements for good painting. For good results, an educational program is necessary to teach the painters and their supervisors what constitutes a good paint job. Teach them how to do a good job. Look what has been achieved in the field of concrete by a proper interest in cement.

If there is apathy and disinterest in painting at supervisory levels, then I can almost guarantee poor painting will result. If the higher levels take an interest in good painting practices, then the painters will do a good job, because of inherent pride in their craftsmanship.

My primary object today is to stimulate interest in learning good painting procedures and presenting some basic philosophy in regards to protective systems. Fortunately, railroad bridge and building personnel have a first class manual on painting steel structures. The Steel Structures Painting Manual has been published in two volumes by the Steel Structures Painting Council. Volume 1, "Good Painting Practice" is an encyclopedia of technical information on paints, how to apply them, how to clean the surfaces, tools, equipment, and the entire field of painting. Volume 2, "Systems and Specifications" is a compilation of specific recommendations for painting all types of structures made of steel and contains detailed specifications for cleaning, treating, applying of paints, and complete paint systems. These books have been prepared at a great cost which has been born to a large extent by the railroads. If any engineer, supervisor, or foreman will read these books, I guarantee that great savings in painting costs will result by application of the fundamental principles and techniques they will learn there. Mr. W. L. Short, who preceded me on the speaker's platform has a burning interest in seeing the railroads take advantage of the latest scientific developments in protective coatings. To avoid duplication of his earlier comments and the detailed information in his committee's report, I shall keep my comments on synthetic materials to a minimum.

Painting

Painting to protect steel is not necessarily economical. Much of the painting which is done is done purely for the sake of good appearance, even though that may not be realized by the user. In dry atmospheres, steel does not corrode. When the humidity gets above 70 to 80, particularly with corrosion stimulators such as sulphur gases in the air, sea water, or brine drippings, corrosion may become severe. In the milder environments, it may be cheaper to replace the steel or to use a galvanized coating rather than paint. Unfortunately, bridge members fail from corrosion in extremely localized areas. By neglect of the rapidly corroding areas, the entire structure may fail even though 99% of the bridge has paint in first-class condition. Conversely, if that 1 per cent of steel which fails through localized and greatly accelerated corrosion could be protected, the remaining 99 per cent of the structure could be permitted to rust. That rusting would be ugly but would not be structurally detrimental.

There are four basic fundamentals in securing economical protection against corrosion:

1. Proper design to minimize corrosion and paint failure and to facilitate repainting.

2. Preparation of the surface to a degree consistent with the intended service exposure and requirements of the priming paint to be used.

3. Correct application of paint in a manner that insures maximum paint life yet is commensurate with practical limitations.

4. Selection and use of paints that are formulated properly and can perform the required service.

Of the above factors, design of new structures is of extreme importance because the

localized failure which constitutes about 1 per cent can be greatly eliminated, good design detail eliminates crevices, cracks, areas where water and brine drippings collect and do not dry out, pockets and traps for collecting corrosion stimulators such as brine, wet leaves, wet dirt, wet cinders, and wet refuse. It is important that the design engineer make possible easy and economical painting. Dry bridges and dry buildings do not corrode. Designs that permit wet steel to dry will achieve great rewards in the reduction of localized corrosion.

Good painting practice realizes that *proper surface preparation is the most important and fundamental requisite to obtaining satisfactory paint life.* This is particularly true in very corrosive environments, such as the floor systems of railroad bridges exposed to brine drippings. Because of the seriousness of the problem created by drippings from refrigerator cars, this paper will be devoted largely towards a presentation of practice adequate for such difficult-to-paint structures. Knowledge of what is required or what constitutes proper surface preparation is basic to the attainment of proper surface cleanliness. For this reason, those interested in the preparation of surfaces prior to painting would do well to study thoroughly the chapters of the Steel Structures Painting Manual devoted to mechanical and chemical surface preparation, as well as portions of the chapters on the painting of railway bridges and highway bridges that are devoted to that subject. The next logical step is to acquaint thoroughly the actual railroad personnel that will be charged with the cleaning with a realization of what is expected of them and of the value of their efforts in prolonging paint life and reducing future repainting to the minimum.

It is absolutely futile to attempt to paint over rust. No known method of painting or coating has been successful when used over rust. Minor deposits of rust which may remain after careful cleaning will detract from the performance of the paint slightly, but are tolerable for atmospheric exposure.

Blast cleaning using a properly selected sand is believed to be the best method of surface preparation in the field. This system is economical for bridges or buildings subjected to corrosive exposure. For normal atmospheres or the areas above floor systems exposed to brine, mechanical cleaning or hand cleaning may be satisfactory and economical. Steam cleaning is an excellent method of surface preparation for dirty, contaminated surfaces because the water and detergents that are employed will remove soluble salts in addition to oil, grease, mud, brine, etc. Steam cleaning should be carried out before hand or power tool cleaning.

Advantages for preliminary steam cleaning are to make the work more visible (thus showing up rust scale and pits better, removing oil, grease, and mud which tend to cake cleaning brushes and works well into the surface or transfers over the entire surface), and softening old paints that can be easily removed. Paint should not be removed, however, unless it is in such bad condition that it is felt that adhesion is inadequate and fresh paint will be carried away from the steel with the old paint. While paint may be removed through the use of a strong detergent and steam, it must not be interpreted that steam cleaning is necessarily detrimental to sound paint. Mild detergents are employed in the preliminary soaking when cleaning of the paint is desired. Selection of the detergent to use should be based upon competent advice. Actually, steam cleaning is a misnomer since streams of hot water at about 300 to 400°F. and several hundred pounds pressure are used. The great advantage of steam cleaning on railroad bridges is that it will remove brine deposits which are soluble in the hot water but are not soluble in organic solvents.

When working on surfaces contaminated by strong corrodants, such as brine, the method of surface preparation should be one which will positively remove the contaminant. Hand brushing or power wire brushing or flame cleaning will not remove salt residues. Following preliminary washing and soaking of strong detergent solution into the old paint and over the dirty surface, a final rinse of clear hot water or steam is necessary. The detergent is removed so that it does not cake or dry on the surface (which would be difficult to remove later), and also so that it does not irritate the workmen. Since these cleaning compounds are alkaline, they cannot be left on the surface because they will destroy adhesion of the paint. Steel surfaces dry quickly after steam cleaning due to the heat stored in the metal. Cracks and crevices will tend to trap water and these must be blown out by a jet of air prior to painting. Normally, 24 hours lapse in time between final steam cleaning and painting are recommended to permit the steel to dry thoroughly. In cleaning bridges under brine traf-

fic, the slight detriment which may occur from water trapped in crevices, and which is not blown out, must be balanced against the definite harm of allowing brine to deposit on the freshly cleaned surfaces and to be coated over with paint. For that reason, painting following steam cleaning as soon as the surfaces are dry is generally desirable. Where steam cleaning cannot be done, then some type of solvent cleaning as outlined in SSPC—Solvent Cleaning Specification No. 1 should be carried out.

After the solvent cleaning operation, the surface should be cleaned of oil, grease, dirt, brine and salt, but these operations do not remove rust scale or tightly adhered rust. The next operation should be a chipping, scraping, or wire brushing operation to remove rust scale. These operations will also remove varying amounts of old paint and tight rust. If blast cleaning is going to follow, then this operation should be a chipping operation to remove heavy scale only. Blast cleaning to remove heavy rust scale is considered impractical due to the waste in abrasives and the excessive expense involved.

Scrapers are generally made from old car springs or a high carbon or tool steel. Designs for tools are to be found in Volume 1 of the Steel Structures Painting Manual. Chipping hammers must be made from high carbon or tool steel, and all tools which are based upon impact, the scrapping principles must be kept sharp to be effective. Large portable grinders should be available at the site of the work.

Scrapping is an effective method for removal of loose rust and is an efficient one. Wire brushing, is not very effective for removing thick deposits of rust or scale. Final operation after chipping is wire brushing. It removes tightly adherent rust from the surface and depends upon the amount of work put into the surface. The amount of rust that remains may vary significantly. Hand cleaning is an extremely costly operation for the results that are achieved. It should be examined carefully to determine if power tool cleaning or sand blasting is not more economical.

Power wire brushing is considered more economical for the reason that the amount of work that can be done by one man is increased many times. The power developed by a man working in the hot sun on a tiresome job is only a fraction of that which can be developed by a power wire brush. Increased cleaning, however, must balance the greatly increased overhead costs. In addition to power wire brushing, there are a number of excellent power scaling tools which are very useful for heavy rust scale They tend to score the surface and cause burrs. Following such an operation, it is a good idea to follow by power wire brushing to smooth out the surface.

In addition, to many styles of brushes available for different types of work to be done, abrasive sanding discs are available which will remove all rust and mill scale as well as old paint. There is no serious hazard associated with the use of power tools; the eyes of the workmen must be protected by safety goggles.

There is no doubt that blast cleaning is the optimum method of surface preparation for steel structures in the field today. Blast cleaning is an expensive operation and the individual railroad must decide for itself whether it is an economical one. In considering whether it is economical, the initial cost should be evaluated against the greatly increased paint life. The general indication is that paint life should be three to four times as long as over a hand cleaned surface and at least twice as long as a power tool cleaned surface. Many reports show greater ratios.

The important thing about blast cleaning is that it be properly done, not just done. It is possible to drop the efficiency of blast cleaning operations down to 5 or 10% of maximum possible through carelessness and ignorance of the operation. The abrasive must be properly sized, must be dry and must be of a suitable nature for the operation. The hose must be of a satisfactory diameter and the length must be kept to a minimum. The heart of the blast cleaning operation is the nozzle. Very costly nozzles prove to be cheapest in the long run because of their long life. Home made nozzles generally operate at low efficiency. The supply of air must be adequate and the piping must not have constrictions or reductions. The typical railroad job has every conceivable type of home made fitting and adaptor and it is not uncommon to see a 2 inch line reduced to ½ inch. The source of air should be checked to make sure that traps are available to remove condensed water and entrained oil. The pressure at the nozzle should be maintained at the highest possible level. A source of fresh air is necessary to the sand blasting operator's helmet.

Careful selection of the abrasive used for sand blasting is necessary. Excessively large abrasives will roughen the surface of the metal so that peaks of metal will be found insufficiently covered by paint. Rusting may then begin at the peaks and undercut the paint. Too fine an abrasive is undesirable for several reasons: Inefficiency in this operation due to cushioning effect of the fine particles, and secondly, fine particles breakdown to such a small size that visibility is impaired seriously or may degenerate to the point where it is impossible to see the work during blasting. Many feel that large size particles are more efficient because they cut faster. The converse of this is true. The smaller the size of the particles the faster the cleaning rate until the particle sizes become too small for satisfactory operation. Detailed instructions for sand blasting are to be found in the Steel Structures Painting Manual. In selecting compressors, a quarter inch diameter blasting nozzle, operated at 80 lbs. per square inch pressure at the nozzle, will consume about 85 cubic feet of free air per minute. To compensate the compressor inefficiency and clearance, the minimum size air compressor for supplying a single quarter inch nozzle at suitable blast cleaning pressure is 100 cubic feet per minute. Wear of the blast cleaning nozzle increases the size of the orifice and in turn the amount of air that must be supplied. This increase in size of the blast cleaning nozzle is not detrimental provided that the compressor has sufficient reserve compacity to keep the pressure of the nozzle up to the necessary level. Once the pressure begins to drop, efficiency drops because of the reduced loss in abrasives. Blast cleaning nozzles are subjected to terrific wear and a synthetic type of material, such as boroncarbide, is preferred because of the long life. Such nozzles are brittle and must be handled with care to prevent damage by impact.

Blast cleaning is an expensive operation and much time is consumed at starting up, shutting down, and in interruptions. It is therefore, only common-sense to arrange a set up which will require the minimum of down time. Everything should be aimed at getting the blasting underway as soon as possible in the morning and continuing it without interruption the entire day. Two operators should be available to relieve one another and to blast during the lunch hour without interruption. Shutting down is mandatory to reload when using intermittently operating tanks. Continuous operating tanks permit more efficient operations.

There are pretreatments that can be applied to clean steel to prove the performance of the paint. Wash primer pretreatment is of considerable value in prolonging life of a paint on clean steel in very corrosive environments. This pretreatment is only a very thin protective coating and it is not a coat of paint. It provides excellent adhesion as well as rust inhibition of the surface. Wash primer is applied by spray or by brush in the same manner as paint. In applying wash primer, it is important to apply it thinly and not to attempt to get the hiding or coverage that a paint provides. Phosphate pretreatments and wetting oil pretreatments are also available for steel. Cold phosphate pretreatments such as those covered in the SSPC Specifications are particularly advantageous for obtaining adhesion of paint to galvanized steel. Wash primers are also extremely useful for this purpose.

Second only to surface preparation in importance is the correct application of paint. Paint may be applied by brush or by spray; both methods have advantages and both have disadvantages. One of the advantages of brush application is very careful coverage of critical points such as rivets, crevices, cracks, edges, and corners. The disadvantages of brush application of paint are the possibility of non-uniform thickness, particularly in brush marks. Slowness is another disadvantage of brushing in many situations. Brush application does have the advantage of working paint into a rough surface and preventing bridging over pits and crevices. However, many of the quick drying synthetic or lacquer types of paints such as vinyls are almost mandatorily applied by spray. Synthetic or lacquer type primers may be applied by brush and worked into the surface and subsequent coats applied by spray. This is good practice also for ordinary paints.

Paint spray equipment has improved tremendously in recent years. Unfortunately, most of the spray painters have little knowledge concerning proper use of their equipment. Here again, it is important to refer to manuals such as the Painting Manual or books issued by the manufacturers of spray equipment. The largest spray manufacturers have schools to which painting foremen may be sent for a week without cost to learn the technique of spray painting. Striping is recommended where time is available. Stripe painting provides an extra coat over rivet

heads, along edges, over crevices, over cracks. It is advisable to permit the stripe coat of paint to dry before applying a prime coat. Where contamination may occur during drying of the stripe coat, then the overall prime coat may be applied first and the striping applied later after the prime coat is dried. Regardless of the procedures that are used, where contamination is a factor, coats should be applied in as fast a succession as possible.

The details of paint application will not be gone into further. A comprehensive specification which covers the application of paint is available from the Painting Council. This specification includes storage of paint, mixing paint, shop, field and maintenance application as well as drying and protection during handling.

Mastic coatings have proved valuable in protecting steel in very corrosive conditions. They may be applied by brush or by spray. If applied by brush, another technique is used rather than the conventional brush-painting technique. Old brushes or daubers are used, and the material is scooped out of the container and applied over the surface in a trowel like manner. It is essential to obtain very thick films for the mastic; therefore, it is not advantageous to brush the material out. There is a great tendency for painters to attempt to apply mastics in a manner similar to that of paints. It is quite possible to produce holidays or very thin spots in brush application. The spraying of mastic is, therefore, recommended; it is a fast economical operation. Special spray equipment is required. A high pressure, compound action type of pump is used to force the material under high pressure through a large diameter pressure hose to the spray gun. There, high-pressure air atomizes the mastic through an internal break-up type of spray gun with a ¼-in. diameter nozzle. Because of the size of the nozzle, the operation proceeds relatively fast despite the very thick coatings which are applied. It is advantageous to increase the distance from the spray gun to the surface to approximately 18 in. The material is put on in a manner similar to watering with a garden hose. A little practice soon shows the proper rate of traverse and good coverage is obtained.

When the coating fails to perform its expected function, a paint failure is said to develop. It must be understood that all paints fail eventually and a failure should only be called a "paint failure" when it is a premature termination of the expected life of the paint. The previously mentioned specifications of the Council should be followed as a guide to good painting. Local spotty failure must be touched up by spot cleaning and spot priming.

The last phase of the painting of railroad bridges to be considered concerns the materials to be used. In the final analysis, a painting job is no better than the materials that are used, but the best materials are worthless if improperly applied or applied over incorrect surfaces. A great many materials have been studied by the Council in an attempt to obtain paint which will be more resistant to the conditions encountered on railroad bridges than those previously used. In the past the majority of paints used for railroad bridges were based upon linseed oil; linseed oil has good durability when exposed to rural atmospheres, but when exposed to conditions involving brine or immersion, saponification occurs and rapid deterioration of the paint generally results. Cases are on record where linseed oil paints which have lasted for periods of 8 and 10 years on the superstructures of some bridges have failed in 6 months when applied to floor systems subjected to brine. The natural tendency is to shift to materials which have better resistance.

Unfortunately, the problem cannot be solved that simply due to the limitations established by the methods of surface preparation and application that have been in use. Almost without exception, the highly resistant paints have poor wetting for dirty, rusty oily, or greasy surfaces. When these highly resistant materials have been used over such surfaces, no better results have been obtained and costs have been higher. With the increasing awareness of railroad personnel to the necessity of thorough surface preparation, it is natural to look again for protective coating materials among the synthetic materials. But these must be field tested to determine whether they are workable. It is hoped that their increased chemical resistance, when used over properly prepared surfaces, will result in sufficiently increased paint life to offset the higher cost of necessary surface preparation. This use of synthetic materials remains to be proved in practice despite all indications that it will suffice. There is also a strong possibility that low-cost coatings applied over poorly cleaned or uncleaned surfaces at very frequent intervals might possibly provide more economical protection. Again, this procedure remains to

be proved. The Steel Structures Painting Council is running tests to find the answers to these questions.

Discussion

A. S. Krefting (Soo) asked when a wash coat should be employed, and Dr. Bigos replied that it was originally thought best to use this with a vinyl paint. However, he has found that the vinyl paint worked well without the wash coat. The wash coat might better be used with conventional paint, he said.

Abstracts of Addresses by Messrs. Newell and Stone before Joint Opening Session

R. J. Stone, vice-president, operations, of the Frisco, spoke on "People, Precision and Progress." He expressed concern that industry generally, and the railroads in particular, have not given enough thought to the social problems brought about by work mechanization. Mr. Stone feels that the railroads have been more successful in developing and applying physical improvements than they have in coping with problems produced by these changes.

Industrial and technological progress have produced a wealth of material things for making life easier and happier, but Mr. Stone implied that, even with these material gains, people are not free from anxieties and frustrations.

He asked these questions:

1. As a consequence of these phenomenal gains do we find complete happiness, exultation and enthusiasm in our employment relationships?

2. Do we find as a result of these achievements a greater ability to work together peacefully, a greater dedication to higher standards of service and craftsmanship? Do we find a greater emotional security and peace of mind?

"Assuming that your answer might be other than a convincing 'yes,' what do we do about it? I am certain that most of you have been faced with this problem.

"What can we as supervisors do to stimulate men to do their best? To see that they receive job satisfactions sufficient to insure their dedication to the welfare of their enterprise—and that I can assure you is essential if we are to keep step with this dynamic, changing age.

"Although wages and working conditions are important, I think we may safely conclude from past experience that we cannot pay a man enough money nor make his working hours short enough to insure his loyalty nor to induce him to put forth his best effort—nor to take pride in his craftsmanship.

"Any employee likes to know that he personally, and the group he works with, is making a positive contribution; this is as important to him as his rate of pay or his hours of work. He wants to know things about his company—the why of its operations, and its policies."

To cope with this situation he offered a few suggestions, admittedly "very sketchy and grossly over-simplified." He would do these things:

1. That we specifically deal with the problems of people as individuals, rather than numbers on the payroll.

2. That we appeal to the strength in a man's character—courage, self-reliance, pride in his craft, ambition—and not to his weaknesses, greed and laziness.

3. That we help the growth and development of each personality on the payroll.

4. That we decide, as people who direct the work of others, to get things done through the process of consultation and explanation, in order to give everyone with whom we work an opportunity for participation. "There is no one thing needed more today in employment relations than this knowledge of being an important part of our organization."

"Granted that this is not easy, but really extremely difficult; that it makes our individual jobs many times more arduous; that it is much easier for us to give commands—each of us here call up experiences in our own past to prove its soundness.

"If we are really interested in succeeding in reaching our full potential, then we must see that people we supervise get inner satisfaction as well as material satisfactions from their daily employment experience. There is no short cut."

"The Road Ahead"

Another management speaker—J. P. Newell, vice-president, Pennsylvania — dwelt on the responsibilities facing maintenance-of-way supervisors for spending the money allotted to them in the most judicious manner. Based on 1955 figures, Mr. Newell estimated that the supervisors are responsible for spending about a billion dollars a year, or an average of $390,000 per year for each supervisor on a national basis. "The immediate problem that you have confronting you," he said, "and where you will be individually responsible on the road ahead, is how you are going to spend this money—how are you going to secure the greatest benefit for each dollar that you expend?"

Some of the answers to the questions he raised are already known, Mr. Newell declared, but he said that these may not be sufficient—that the problem is much greater than merely getting the greatest possible value from the expenditure of a billion dollars a year. The real problem, he said, is to increase efficiency to such an extent that the same standard of maintenance will be obtained for less than a billion dollars.

While the future will present many problems, Mr. Newell feels it will represent a "challenge for those who are willing to avoid complacency and who are interested in tackling and solving the problems which they will encounter — with the exhilaration that comes from accomplishment, and the contentment in the knowledge of a good day's work well done. It is a challenge for those who are anxious to move ahead to positions of greater responsibility."

Coach Watering Facilities Must Be Sanitary

Report of Committee

COMMITTEE—C. B. Foster, *Chairman*, b.& b. supv., Sou., Greensboro, N.C., H. O. Adkins, *Vice-Chairman*, gen. supv. b.& b., D&RGW, Denver, Colo.; R. H. Bush, *Vice-Chairman*, w.s. supv., T&NO, Ennis, Tex.; E. M. Cummings, div. engr., B&O, Connellsville, Pa.; M. H. Dick, ed., Ry. Trk. & Struct., Chicago; R. Miller, prin. asst. engr., B&A, Houlton, Me.; J. H. Stinebaugh, supv. w.s., IC, Carbondale, Ill.; E. M. Enger, supv. b. &b., CStPM&O, St. Paul, Minn.; J. W. McGlothlin, div. engr., CMStP&P, Aberdeen, S.D.; E. F. Snyder, asst. to ch. engr., IC, Chicago.

C. B. Foster
Chairman

The problem of effectively eliminating the hazards of contamination in watering coaches is a troublesome one. It is an important phase of railroad practice and will appear at times to be difficult to solve, especially in crowded coach yards and limited station ground space; but with improved methods and equipment, the problem can be attacked with the practice of sound sanitation principles, of which there are many.

Water treatment is a sanitary problem and must be considered in any coach-watering facility, yet for brevity in this report, we shall assume the source of supply to be pure and adequate and only deal with the transfer of this supply to coaches. Each locality presents a different problem, as one type of facility which is satisfactory at one location will not satisfy the requirements at another.

The sanitation requirements for coach-watering facilities as outlined by the Interstate Quarantine Regulations state that: Necessary sanitary facilities are operated and maintained so as to prevent the spread of communicable diseases; water must be obtained from points approved by the Surgeon General; only potable water is provided for drinking and culinary purposes; all platforms where water is transferred to conveyances shall be adequately drained so as to prevent pooling; and all servicing area piping systems, hydrants, hoses, buckets and other appurtenances shall be designed, constructed, maintained and op-

erated in such a manner as to prevent contamination of the water.

Any non-potable water outlets should be posted with permanent signs, warning that the water is unfit for drinking. The fittings on these outlets should be of such a type as to prevent the attachment of drinking water hose. There should be no cross connections between the potable water system and a water system of questionable quality. The piping should be of sufficient size to insure positive pressure throughout the system at all times. Shut-off valves should be located between each hydrant and the water main.

The hydrants should be of the acceptable type to insure against any possibility of becoming contaminated from toilet hopper discharges, either directly or by splashing ground surfaces or sub-soil around the hydrant. Hydrants shall not be located in toilet rooms, washrooms or other places where contamination may exist or result from operating conditions. Hydrant outlets shall terminate in downward bends or goosenecks and be protected against contamination while the hydrant is not in use. Where flush-type hydrants are used, the hydrant box should be durable, watertight and have an overflow opening. If the hydrant is of the post type, the required horizontal distance from the center line of the nearest track to the outlet can be any distance as dictated by safety precaution, provided that the outlet is 30 in. or more above top of rail. Should the outlet be less than 30 in. above top of rail, then the clear horizontal distance from the center line of the nearest track should be at least six feet.

The minimum distance from the center line of track for new track installations relocation of tracks, or at any time of major repairs, where space is available, should be at least 7 ft. Where hydrants are located in unpaved areas, they should be protected by impervious platforms of a size, slope and height sufficient to prevent the formation of pools from spillage and flushings. These platforms should be no less than 3 in. thick and 16 sq. ft. in area.

No hydrant box drain or riser pipe drain should be connected directly to any storm or sanitary sewer. All drain lines receiving drainage from more than one hydrant box or hydrant riser pipe drain should be watertight and at least three (3) in. in diameter and should discharge to either the ground surface at a point not subject to flooding, or a sump, from which waste water is pumped either to the ground surface or to a sewer through an air gap connection located above grade. Duplicate pumps should be provided.

Hoses should be of serviceable material, which conforms to the specification of the Association of American Railroads or their equivalent. The hydrant end of the hose should have a quick attachment type coupling, if not permanently attached to the hydrant outlet. The hose ends should not at any time come in contact with the ground, and when hoses are not in use, they shall be stored on special reels or in special lockers or pits. Nozzles should be of smooth material, without frayed ends, and protected by a cover or cap when not in use. It is also necessary that the hose be thoroughly flushed before any water is used from it. The water filling connection on the car should also be flushed just before the hose is attached for watering the car.

Water buckets are necessary to deliver water from hydrants to certain types of drinking water tanks and should be easily cleanable and provided with overlapping covers, which are fastened to the bucket. Buckets should be kept clean and labeled, "For Drinking Water Only." Storage cabinets should be provided and should be labeled, "For Drinking Water Buckets Only."

An important sanitary requirement sometimes overlooked are suitable employee conveniences, for without them watering-point personnel are deprived of the clean and sanitary conditions required for proper hygiene. Equally important is the policing of station grounds and servicing areas. Above all, a course in water handling sanitation should be given the persons responsible for servicing areas. This could be a most valuable asset to any company operating sanitation facilities.

This report does not attempt to cover all sanitary requirements, nor will it attempt to solve all the problems in connection with complying with these requirements. It can be noted that the requirements covered are closely associated with State Health requirements, as the Public Health Service and State Health Departments work closely together in executing compliance with regulations as set by the Interstate Quarantine Regulations.

Certainly the most complicated aspect of complying with these requirements is the selection of the proper hydrant and its installation. Therefore, the committee has directed its attention to the available proprie-

tary equipment, which has been or is being proved satisfactory on various railroads and is also acceptable to the Public Health Service. Of course, flush-type hydrants or systems using under-ground riser-pipe drains are still in existence. They can be reconstructed only under special circumstances, where overhead systems or systems using hydrants of the acceptable type are not practicable.

An improved frostproof post hydrant that is said to operate efficiently with positive action the year round, even in the coldest weather, is now on the market, and the reaction from those that are just beginning to use them indicates that they seem to work fairly well. The self-de-icing design frees the hydrant spout of any ice, when the valve operating lever is pulled. The spout of this hydrant has an elastic water tube lining that is designed to contract after each use of the hydrant. A small amount of water remains in the tube along the internal separator strip. Under freezing conditions, it forms in thin ribbons of ice. When the operating valve is again opened, the in-rushing water travels up the separator strip and quickly breaks up, melts, and evacuates the ice through the spout. The entire unit—below and above ground — is completely sealed

U. S. Department of Health, Education, and Welfare

Public Health Service, Washington 25, D. C.

List of Acceptable Interstate Carrier Equipment Having Sanitation Significance

This list has been prepared as a guide for the public health service; airline, railroad, vessel and bus companies operating in interstate traffic and all American flagships in connection with the installation of new equipment. Only items used by these companies on their conveyances or in their servicing areas or by their catering establishments are included.

The Public Health Service, upon receipt of requests from carriers, examined the items of equipment listed to determine compliance with the Interstate Quarantine Regulations of the United States. Only those items found to comply with these Regulations are included on this list; however, carriers have the obligation, in complying with the Regulations, to make certain that the equipment is properly installed, operated and maintained. Proposals for installation of unlisted equipment should be referred to the Public Health Service, Division of Sanitary Engineering Services for determination of acceptability.

Lists are issued April 1 and October 1 of each year. Each list supersedes all previous ones. Additional copies of the list and related information can be obtained from our regional offices.

A particular equipment item may not appear on this list for one or more of the following reasons:

(1) A request for review has not been received from an interstate carrier.
(2) It does not comply with the requirements of the Interstate Quarantine Regulations.
(3) It is currently under consideration as to acceptability.
(4) It is in a category of equipment which will be scheduled for review as resources permit.
(5) It is in a category of equipment not included in the review program.
(6) It complies with Interstate Quarantine Regulations but is a custom-made item or manufacture has been discontinued.

This listing relates only to findings of compliance of the sanitation features of the specified models with the requirements of the Regulations, and does not constitute an endorsement or recommendation of any item listed. Also, there is no intention to imply that the equipment items listed under the various headings are necessarily equivalent to each other in durability or performance nor that they meet all claims of the manufacturers.

(Signed April 1, 1956)

Elroy K. Day
Equipment Review Activities
Interstate Carrier Section

Frederick S. Kent
Chief, Interstate Carrier Section
General Engineering Program
Division of Sanitary Engineering Service.

against entry of any pollution that might contaminate the water supply. An assembly wrench is the only tool needed to unscrew the valve body from the housing. The valve stem and the entire valve assembly can then be lifted through the top of the standpipe. Another advantage of this hydrant is the complete elimination of any heating elements. This type of hydrant will freeze if a hose is attached and left under pressure. It should never be thawed out with flames.

The design of the post type circulating hydrant not equipped with a strip heater is based on the theory that flowing water does not freeze. In order to have a continuous flow of water under the seat of the hydrant after it is shut off, it is equipped with special fittings. As water flows through the supply main and through the special fitting, a certain portion of this water is directed up through the hydrant outlet pipe just under the seat of the hydrant and is then directed to the return flow pipe to its special fitting on the outlet side of the hydrant. This arrangement maintains a continuous flow of water circulating through the hydrant when not in use. Where the temperature range would be below 32 deg. over a period of 24 hours or more, the manufacturer recommended that the hydrant be equipped with a strip heater. An installation made in 1947 on one railroad is reported to have given no trouble.

Satisfactory results have been obtained by the use of another type of hydrant, which can be used either as a post hydrant or used in connection with a water service box at track level installation. This fixture is designed to deliver a small amount of water by just cracking the valve or a full 1-in. stream when the valve is wide open. The hydrant consists of a casing pipe housing a piston and valves. The riser pipe is attached to the exterior of the casing. When the lever is operated in a counter clock-wise position, the piston moves downward, and in doing so, opens the bottom valve, allowing water through the riser pipe. When operated in a clock-wise position, this allows the piston to move upward, the pressure closes the inlet valve and the piston draws the remaining water in the riser pipe down into the cylinder, which is below the frost line. All operating parts are easily accessible and can be repaired or replaced without removing the fixture from the ground.

Overhead installations are preferred by health authorities where ample space is obtainable. Such installations, properly installed, definitely reduce or eliminate the possibility of picking up pollution. Several roads reported having one or more overhead installations, and generally speaking, the designs are identical. One such installation in the West consists of an overhead water main the full length of a coach yard, with overhead laterals crossing over the coach yard at 200-ft. intervals, with outlets at every other track, which greatly reduces the amount of hose required for servicing the coaches. The installation is prevented from freezing by wrapping the pipe lines with electric microwire, then covering it with fibre glass insulation over which is placed a weatherproof casing. The temperature is thermostatically controlled and the installation has proved to be very satisfactory. Some roads use steam-tracer lines, either manually or thermostatically con-

Railroad Coachyard Watering Hydrants (Frost-Proof Type)

Manufacturer	Item	Model or Cat. No.
Crane Company	Crane sanitary water hydrant Design No. 3	Catalog No. 840
The Murdock Manufacturing & Supply Co.	"Expelo" sanitary coach watering post hydrant	"Expelo"
Railroad Products Company	McGarry yard hydrant	Style CY-471
"	Sisson circulating hydrant (post-type)	Type S-60 A
"	Sisson circulating hydrant (post-type with heater)	Type S-65 H
Snyder Company	Railroad sanitary post hydrant assembly	No. 2731 - 1"
J. A. Zurn Manufacturing Co.	Sanitary post hydrant—non-freezing	Model Z1485

trolled, adequately trapped within the insulated system, for frost-proofing the overhead systems.

One road reported having trouble with burned-out electric immersion heaters which allowed diesel-servicing hydrants to freeze. The trouble is believed to have been caused by the fact that the immersion heaters were not separately controlled by individual thermostats, although the non-circulation of water in the riser pipes and around the heaters could have contributed to the failures. An interesting solution, though unattractive, was to build small, insulated shelter houses over each hydrant and valve and install thermostatically controlled electric hot-air heaters having a circulating fan. The result was reliable operation throughout a severe winter.

All roads reporting seem to be using more or less the same type of hose connections, that is, those with the quick-type, quarter-turn couplings, furnished with six-inch discs to prevent the nozzle from coming in contact with the ground or platform. The hoses are also furnished with sheaths or caps which are to be applied over the ends of the hoses, when they are being rolled out or when not in use. Hose holders, attached to the top sides of hydrants, are satisfactory for holding the nozzles when they are not in use.

In conclusion, the committee would like to emphasize the importance of submitting construction plans to the nearest health agency of the state in which construction or major reconstruction is to be done. In this way, early approval can be obtained without delay. Close coordination with the representatives of State Health Departments, during their inspection of watering points, and the immediate correction of exceptions will reduce the possibility of any water contamination and will indicate to them that your interest in coach-watering practices is genuine.

The Supervisor—His Records, Accounts and Cost Information

Report of Committee

COMMITTEE—R. H. Miller, *Chairman,* prin. asst. engr. B&A, Houlton, Me.; S. Fogarty, Jr., *Vice-Chairman,* asst. supv. trk. and b.& b., C of Ga., Columbus, Ga.; J. K. Morrissey, *Vice-Chairman,* supv. m.w. reports, C&O, Richmond, Va.; E. H. Barnhart (ret.), div. engr., B&O, St. Petersburg, Fla.; G. S. Crites (ret.), div. engr., B&O, Baltimore, Md.; A. M. Glander, ch. carp., CMStP&P, Austin, Minn.; J. E. Heck, supt. b.& b., C&O, Ashland, Ky.; J. M. Lowry, ch. engr., StLSW, Tyler, Tex.; W. T. Towle, supv. b.& b., NYC&StL, Brewster, Ohio; Shirley White, gen. b.& b. supv., SP, San Francisco, Calif.; N. H. Williams, b.& b. mast., D&H, Oneonta, N.Y.

R. H. Miller
Chairman

The scope of this report, as defined by this association's Executive committee, is "to develop the various kinds of records, accounts, cost data, statistics, reports, and material handling procedures with which a supervisor is generally faced. The report should outline a series of practicable ways and means of keeping abreast of such paper work, particularly with respect to accurate cost data and accounting for work performed."

The best way to start is to name and explain the ways of controlling expenditures used by several roads. The control of expenditures may be divided into that required for normal maintenance projects, AFE projects handled with carrier forces, and contracted projects. This control can further be divided into material costs, labor costs, and fixed charges for ownership and maintenance of equipment.

The supervisor referred to in the title of this report would be on a divisional level for

a larger railroad, or on an entire road level for a smaller railroad.

The control of expenditures is one of the most important jobs assigned to a supervisor in modern railroading. A supervisor is not only responsible for getting the necessary work under his jurisdiction done efficiently, he is accountable to management for the proper handling of money allotted to various projects. It is necessary that the supervisor look at each project through the eyes of management. With this outlook, he will make every effort to see that ordinary maintenance, and special projects are carried out in as economical a method as possible. He should keep within estimated costs, or be fully prepared to explain in detail the how, why and what of abnormal over-runs or under-runs. If expenditures can be predicted to come out more than ten per cent under, or more than ten per cent over, the estimated cost, management must know as soon as possible. Management usually has a list of pending projects which are worthy of execution, but rarely has enough money to execute them all when desired. For this reason, it is important that under-runs be made available for other projects, or applied against projects which may over-run.

The control of expenditures affects all phases of railroad accounting, such as income tax payments, amortization of debts, payments to stockholders, maintenance of way ratio, total operating ratio, etc. If each supervisor does his part, the net results will show up in a company that has a healthy financial condition, able to survive in today's highly competitive transportation picture.

The supervisor's records for controlling expenditures may vary from the simple expedient of a "foreman with a sharp pencil," to the many statistics produced by the machine bureau or the company's accounting department. In most railroads, the start of control is at the planning level. Estimates must be realistic, they must be based on up-to-date material and labor costs. These estimates should be revised immediately before a project is authorized. They should take into account any material or labor increases anticipated prior to or during construction.

Estimating is usually done in the office, where most records are kept, and where the overall picture of authorized expenditures is available. Necessary field data are furnished, and, if deemed advisable, estimators may make field trips to familiarize themselves with projects. (The term project used here and following shall be loosely applied to operating expenditures as well as AFE and contract jobs.) The office in charge of estimating informs the supervisor and field forces of cost of material, and anticipated quantities of labor to be expended by various means.

In the case of operating expenditures, the supervisor may be merely given a force account sheet, which indicates the allowable work force for various periods of the year. Materials used in conjunction with this labor can sometimes be arbitrarily applied as a percentage of the labor. Thirty-five per cent of the labor item will usually cover issue of store stock items used in normal maintenance of way work. This percentage should be tailored to suit one's individual requirements.

In the case of AFE items, a supervisor may merely see the estimate or plans long enough to pick off material to be ordered, or he may be issued an annual project booklet. This project booklet will list all projects that are expected to be fulfilled during the year. Each project will be defined in detail, with expected unit costs for labor shown. Also, as a yardstick, past unit costs may be shown. At any rate, no matter what form this preliminary data takes when it is presented to the supervisor, he must take the time to digest it, and put it into form for ready reference and assimilation. He is accountable to management for proper management of material and labor costs. The information passed down to him is usually the best means that management has available to keep him up to date.

Many roads have found it advantageous for the supervisor to divulge some of his cost data secrets to the foreman on the job. He must let his men know what his objectives are, and what is expected of them. If a foreman, for example, is told that his road placed mass concrete, or drove trestle piles for a certain unit cost last year, he will make every effort to equal or better this record. Disinterested foremen are often the main cause of over-runs on projects. Where seniority has been put ahead of merit and ability, this condition is especially acute.

On contract projects, cost control is sometimes merely an inspection of the job as it progresses. By virtue of his signed contract the contractor is required to perform a certain quantity of work for a certain unit price, and to finish within a specified time. The responsibility of the inspector on the

job is to assemble performance data, and report them to his supervisor who, in turn, reports to management. If any portion of the job falls behind schedule, he handles this with the contractor.

The data sheets required by foremen who report costs are quite varied, according to needs. A time sheet with places for the foreman to enter each unit of work is essential. Some roads have adopted a time sheet that is divided into the various operating accounts. The operating accounts are then sub-divided into codes, or units, that make for easy correlation into cost-control items. An example of this would be the operating account applicable to reconstruction of a deteriorated freighthouse. This reconstruction could be divided into codes covering excavation and backfill, concrete, framing, exterior wall covering, roofing, interior finish, plumbing, and heating. The coded items are then assembled for many jobs by the accounting bureau.

It is entirely possible that the supervisor can, in the simpler cases, take enough information from the time sheets as they pass through his office to gauge or measure the progress of the job cost-wise. By comparing this cost with the progress evident by field inspection, and the estimate, plans, or project booklet, he is able to estimate whether or not he will stay within the goal established. This method at best, gives the supervisor only an approximation, as he usually doesn't have the time nor the help to do more than make a few quick pencil computations. A careful look at a bridge and building crew's weekly time sheet will tell the alert supervisor whether or not there is a normal force on a job, and how much time was spent on it. Every supervisor has, or should have, at his fingertips the necessary rates so that the labor cost for a project can be computed.

The system of accounts and codes described above lends itself to methods and cost control work as they are carried out on some railroads. The time sheets are transcribed on punch cards, and the necessary information assembled, summarized, and printed. The printed summary then is available for comparing with set standards based on past performance. The set standards are devised from a careful study of a fairly long period of printed summaries. Probably as much as a year's time will be required in order to set standards for most jobs that will be encountered on the road. The set standards can and should be used as a basis for budgeting expenditures for almost all projects. This is in addition to the everyday use for comparing with projects under construction. These standards are only of use if they are regularly revised to account for changing conditions. Only by being alert to all modern trends and developments, and applying them where applicable, can the supervisor improve the work carried out under his direction. The supervisor is accountable for his cost of operations in direct ratio to the degree of authority that is given him to carry out his responsibilities.

The theory of methods and cost control has been dwelt upon at length for several reasons. First, it has been proven that a supervisor and clerical staff assigned to this work can assemble enough information on faulty practices, or practices that can be improved upon to more than pay for their cost. Second, by setting up standards, a supervisor no longer need guess at how long it will take one of his crews to do a job involving one or more units of work. Third, the immediate supervisor cannot always spot faulty practices, and these show up in methods and cost control statistics.

These statistics may come to light too late to help the project being currently handled, but will certainly be available for future guidance. For instance, one shop on a smaller road found that all its mechanics and electricians had fallen into the practice of stopping productive work an hour before quitting time, and switching to janitor work. This quickly showed up on the methods and cost control summary as being out of proportion to the amount of janitor work required. The unbalanced situation was remedied by assigning one man to janitor work, and being able to do an increasingly larger work load without hiring additional manpower. Fourth, all of the payroll is accounted for in man-hour statistics. The jobs which make up the larger portions of the total as summarized can be carefully scrutinized on a systematic basis rather than a hit or miss basis.

Publications with which a supervisor ought to be familiar are many, but only a few are "must" items. Probably the most important book which should always be available for ready reference, is "The Interstate Commerce Commission Uniform System of Accounts for Railroad Companies." This book and its contents are the basis for all records kept by railroad companies. The operating and road and road and equipment accounts are divided into sub-accounts, and cover all phases

of maintenance and new construction work in the railroad field. Cost control can be practiced to a certain extent by ratio analysis. This is used by management and comparison with other roads' statistics is by means of ratio analysis. The ratio can have any identification, but is usually classified as dollars per ton-mile, or per mile of road.

Another publication which is quite valuable is Chapter II, Part 3, American Railway Engineering Association Manual, entitled "Cost Keeping Methods, Statistical Reports, and Forms for Analyzing Expenditures for Assisting in Controlling Expenditures." This portion of the manual deals mainly with budgetary requirements and procedures, but many valuable hints are available which should be of assistance to the supervisor.

Current trade publications are of interest and value. When another road, or the railroad supply field, develops a tool or process that works to advantage, it is the duty of the supervisor who reads about it to investigate it, and sell it to his superiors if he can justify its use. If other roads have benefited from a new development, it is up to the interested supervisor to separate facts from opinions and plan his work accordingly. He can do this by preparing statistics showing past and proposed practices on the operation in question.

Proving savings on capital investments made, or about to be made, can be a complicated process, but in this modern day, sufficient clerical help is not available to keep elaborate records and statistics. For that reason, the supervisor should have readily available a few basic statistics. He must work with reasons, not excuses. The most important group of statistics, as previously mentioned, is labor rates. Labor rates are required so that expenditures per unit of work performed can be computed prior to and subsequent to the capital investment. Other rates which need to be determined are for cost of ownership or the capital investment, which include fuel, maintenance costs, depreciation (if one's road uses depreciation accounting), insurance, taxes (if applicable) and interest on the investment, if your road's management believes that this is a cost of ownership item. All these must be computed for a period of time, deducted from the labor saving, and a net saving per unit of time of production computed.

These statistics need not be based on an elaborate system of accounting and records. A simple approximation using rates at hand, and common knowledge statistics on production time will usually suffice. It is felt that the supervisor, by familiarizing himself with a few basic figures, and by using figures from his notes while on the job, can come up with savings figures that are very close to what would be gotten if more elaborate records were kept, provided he works with causes and not effects.

Reports that a supervisor makes to his superiors may be complicated, or simple. Elaborate reports can be obtained from the methods and cost control office that are about up to date. They show the performance of all crafts on their work as compared to other men in their crafts, or set standards. Most roads have a monthly "Status of AFE's" report, compiled from accounting department statistics. This is quite valuable. Discrepancies on smaller projects are usually not detected until too late to do anything about them. The superior has a perfect right to criticize the supervisor if a job under his direction has over-run, due to the supervisor's failure to plan and to control. Again, we come back to the alert supervisor with a sharp pencil and a few statistics in the back of his mind. Calculations while visiting the job usually can be made, compared to the estimated cost, and an oral or written report given the superior. He must give the cause as well as the effect.

The supervisor should see that his foremen keep labor and material charges correctly. This will help him to maintain control of a job. Also it gives the foreman a sense of responsibility. Well-informed foremen usually do a good job of supervision if they know they have possession of all possible data and information. Plans should be made common knowledge. They should be written if possible. Too many times a foreman sends in time or material sheets that are incomplete or incorrect. It is essential that he be instructed in the proper keeping of records. This data are required for everything from the preparation of a payroll to the submission of records and data to the Interstate Commerce Commission.

Completion reports can be a valuable source of data, if proper information is available to make them a true reconstruction of the job. Too many times the valuation account has to "second guess" the foreman on the job when going through his labor and material records. Normally, the preparation of faulty reports consumes just as much time

as the preparation of correct reports. For that reason, the supervisor should insist on properly prepared reports passing through his office to the valuation staff.

Maintenance of way ratios should be of more than passing interest to the supervisor. The maintenance-of-way ratio is defined as the ratio of maintenance-of-way expense to revenue, expressed as a percentage. Some managements think this ratio should stay fairly constant for a healthy financial structure. As can be seen, as revenues decrease, so should maintenance-of-way expenses in order to keep the maintenance-of-way ratio constant. This is to satisfy stockholders, and financial interests who might be invited to invest capital in railroads. The supervisor must then gear his maintenance program to the maintenance-of-way ratio, and do his best with the money made available.

In addition to the above, which has mainly detailed methods of cost control, and cost records, the supervisor must keep a series of recurring records. These are inspection reports of bridges, culverts, scales, turntables, and other equipment peculiar to one's sphere of supervision. There are force account records, seniority rosters, and other personnel records which the supervisor must see are maintained. There are many periodic inspection reports submitted by supervisors and their inspectors. There are annual reports, both to stockholders and to the Interstate Commerce Commission, and other corporate reports with which the supervisor could well become familiar. A separate report could be written about most of these records, but it is felt that cost is the most important thing in the supervisor's mind. For that reason, all other maintenance and corporate reports have been considered extraneous. The supervisor should periodically review the records handled by his office, and discard any no longer required.

In summary, records are a tool of management, kept as a means of saving money. The supervisor is expected to be flexible in his thinking. Supervision is composed of (1) planning, (2) control, (3) goals, (4) review and appraisal, and (5) action. To further elaborate:

(1) The Supervisor must determine a course of action for his forces;

(2) He must check progress at regular intervals;

(3) He must set a completion date;

(4) He must make a careful analysis of the work to be carried out;

(5) He must actively push money-saving ideas;

(6) He must keep progressing by looking for a better way to do a job.

The supervisor must make his organization work by promptly and regularly supplying him with the necessary records and data. He must take time to plan and use the records available to their fullest extent. Records must save money, not cost money. The supervisor is a tool of management that, by proper use of records and data, is being sharpened for the most profitable use to his company.

Discussion

W. H. Huffman (C&NW) asked how many railroads had gone into machine accounting. President Jorlett said that the track department of his road is already reporting on units of track work performed. The B&O track department is also using the IBM-card system for labor accounting, continued Mr. Jorlett. His own track department, he said, knows within two days how much time each unit of work required. While the B&B department of his road has not yet gotten into this very much, it will do so as soon as a code system for each type of job can be worked up. As it is, he said, the bridge and building department does not know within the 26th of the following month how much time is being spent on various kinds of work. But with machine accounting, he said, he hopes to get this information much sooner.

C. E. Garcelon (B&A) reported that the track department on his road has a cost-control plan pretty well organized at this date, and they have now started setting up code numbers for the bridge and building departments. The system will go into effect in about two months, he said. One of the difficulties, he said, is the great variety of bridge and building work which makes the setting up of a code system very difficult. The foremen on his road seem to be accepting the idea of a code system as they do not anticipate as much work for reporting.

Mr. Huffman reported that he is now engaged in devising a code plan for all phases of maintenance work. Already he has over 6000 numbers for the track department. He believes that this system is a coming thing

and that all roads will eventually come to it. He admitted, however, that it takes a great amount of work to set up such a plan but that it is worth it because it will provide management with a modern way of obtaining up-to-the-minute information in time so that both the costs of materials and labor can be controlled.

Mr. Garcelon stated that he thought it would be a good thing to be able to tell the foreman in advance how many crew days he has been allotted to do a certain job as this will help him plan his work. However, another member stated that jobs can vary in cost because of climate and location so that it would be difficult to set up an average figure. Mr. Huffman stated that he did not believe that management is going to hold the foreman or supervisor to an average because they will appreciate the fact that there is a difference in local conditions.

Mr. Garcelon stated that in setting up a standard for the first year, it is important that the foreman give a good report on the labor required. If he selects one phase of the work he may overrun on another. He stated that he is telling his foremen to make honest reports, because it is only with such reports that good averages can be obtained.

Moving the B&B and Water Service Gang Over the Highway

Report of Committee

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J. L. Perrier
Chairman

The fact that the railroads are in the transportation business requires that they have facilities spread over thousands of miles of road, and those facilities must be constructed and maintained. It is the customary practice for the maintenance crew to report for work at a permanent or temporary headquarters and travel as a group to the site of the work.

Since travelling to and from the job may comprise from 10 to 30 per cent or more of the working day it is important to hold this unproductive time to the lowest possible minimum. The basic elements involved are, first, the distance from headquarters to the point of work, and, secondly, the speed in which that distance can be traversed. In large urban areas and terminals where there is dense train movement and congestion, the moving of crews by motor car is not economically feasible and it was in such areas that most railroads first took the maintenance forces off the rails and put them on rubber. The savings that were realized warranted expanding the programs for purchase of trucks. Within a few short years the practice has become so universal that it is not unreasonable to expect that in a few years the use of the motor car for transporting of B&B and water supply gangs will be limited to service only as an auxiliary to the truck.

A brief enumeration of some of the advantages of transporting gangs by truck would include the following: Decrease in travel time. In this respect it was interesting to note that the replies to a questionnaire consistently reported increased productivity of from 20 to 30 per cent for the larger gangs of 10 or 12 men.

A second advantage was the greater distance that could be economically travelled. A radius of 40 to 50 miles from headquarters is not unusual. While it is not customary to have a large crew working on programmed work headquartered so far from the job site, mobility is important in the case of a small job involving only a day's work. This particularly applies to the water supply gang who periodically cover their district, making minor repairs, adjusting valves, or checking meters and water-treating devices. Increases in productivity in such cases often reach 50 per cent.

A third advantage is the reduction of time in getting men, tools and materials to the scene of a derailment or washout or other emergency condition. Frequently in such cases access by rail to the actual point of work is blocked by wrecking equipment and it is necessary to carry the tools and materials for comparatively long distances. The use of a truck reduces this distance. It is generally found that the time in getting to the point of emergency is less than 40 per cent of that required if motor cars or work trains are used as a means of transportation. The truck has a greater carrying capacity than the motor car and reduces the number of trips in getting men, materials and tools on the job. Because of the greater distances that can be travelled within the workday period it is usually possible to reduce or eliminate entirely personal expenses paid account being away from headquarters over night.

One last advantage which we will list is that of comfort. I think you will agree that a motor car is anything but a pleasant vehicle. It probably would be impossible to develop statistics to show how many man-hours a crew lost in the course of a year because it started to rain or storm shortly after the men reported for work and they could not get out on the open motor car for an hour or two. Or that the weather became threatening in the middle of the afternoon and the crew was 10 miles from home. With a truck the men will lose much less time because they have the means to get to and from the job with a reasonable degree of comfort and safety.

There are many different types of trucks used by the B&B and water service gangs, but in general they can be classed as either the service or transportation type.

In the service type category, probably the most common truck is the standard commercial panel-body type. As a rule they are of the ½-ton or 1-ton capacity. Compartments and shelving along with tool racks can be easily and economically installed. While it is the usual practice to assign such trucks to crews consisting of only two or three men it is simple to add benches and carry up to ten men. One of the advantages of this type of truck is that it provides an economical means of transportation for small crews who are carrying small tools and a limited amount of material. The fact that these can be kept locked up makes it possible to keep the tools in the truck except when they are being used and therefore the machine is immediately ready for movement in case of an emergency.

The standard commercial pick-up truck with an open bed is also used extensively. Usually they are of the ½-ton or 1-ton capacity. On some roads this type of truck is provided with utility compartments for tools and small material items. Where used by water service gangs pipe racks and vises are installed.

The most complete self-contained unit is the service-shop truck. The size normally used is the 1½-ton chassis and cab with an insulated body, although in some cases a 2½-ton capacity truck is used. The 1½-ton type is sufficiently large to permit the installation of power tools and machinery necessary for the water-service department to handle almost any repair or construction work. This includes the usual tool compartments, racks, a work bench, vise, power-operated pipe cutters and threaders, welding outfit, a compressor and an electric generator. In order to facilitate handling of tools, the doors of the compartments may open from the outside. Naturally all doors will be provided with sturdy locks.

The so-called transportation truck is usually of the stake or flatbed body type and is used for the general hauling of tools, machines and materials as well as the crews. Cabs large enough to carry five or six men are sometimes used, but where the crews consist of eight or more men a canvas top

on bow strips can be installed and seats placed in the bed of the truck. Trucks of this type were usually of 1½-ton capacity until recently but in order to increase its versatility, replacements with trucks of 2½ or 3 tons capacity are becoming more popular. Also to increase its versatility this type of truck is often equipped with various attachments such as truck cranes, winches with gin poles, hydraulic bed-dumping device, hydraulic towers, air compressor and floodlights. Where operating agreements permit they may also be equipped with flange wheels and hydraulic turntable so that the truck can be run on either the highway or on rails. All of these attachments reduce the manual handling of heavy materials to a minimum and expedite loading and unloading as well as placing of such material. Another important feature is the improvement in the safety factor.

In some cases trucks of similar capacity as the above are of the van type with the truck bed enclosed.

Another popular truck is the dump-body type, particularly with the combination platform and dump body. Generally these are from 1½ tons to 2½ tons capacity, but may be as large as 5 tons for very heavy work.

Although there is probably a substantial percentage of tracks where there is a parallel roadway, there are on almost every district certain locations that are not readily accessible by truck and it is necessary to depend on the motor car. One method of solving this problem is to carry the motor car in the truck and unload and load it at a convenient crossing near the site of the job by means of a portable ramp. A second method, which permits maximum use of the space in the truck, is to provide a small lightweight trailer to carry the motor car. By the simple process of tilting the trailer it serves as a ramp and the car can be quickly and safely loaded and unloaded. Such trailers are usually of the single-axle type. Larger trailers of both two-wheel, four-wheel, or multiple-wheel types, depending on the carrying capacity, can be hauled behind the truck to transport heavier machinery such as small off-track cranes, earthmoving machinery, large compressors, concrete mixers, or heavy and bulky materials. Special equipment on these trailers, such as electric brakes, lights, hitches, etc., vary according to the size and carrying capacity and the requirements of the states in which they are operated.

In the beginning of this report it was pointed out that one of the basic problems in maintenance of the railroad facilities was to get the crew from its headquarters to the job site in the least possible time. While the truck has contributed toward helping to solve that problem a comparatively recent innovation is also offering another solution. This is the off-track trailer for housing.

The railroads have always had the problem of providing living accommodations for their floating gangs and it has become pretty much traditional on most roads that such living accommodations shall be provided at the expense of the railroad. Since mobility of the camp equipment is essential the company provided the necessary sleeping, cooking, dining and washing facilities in railroad cars, usually by remodeling existing units of rolling stock that no longer served the purpose for which they had been originally constructed. The camp was moved to a siding as near as possible to the job site, but in many cases this could be quite a distance, either because of the fact that water and electric service was not available or that other tracks closer to the job were exclusively required for operational use.

There was also the problem of moving the camp from one location to another. During the early years in the life of the railroad industry this probably was not too serious as the trains were short and were run with greater frequency. However, during recent years, and particularly with the dieselization of the industry, the trains have been lengthened considerably with fewer trains being operated. Often the only train available to move the camp is operated at night and additional provision must be made to take care of the crew while in transit. Then, too, on lines with a light traffic density revenue trains may be operated only two or three times a week and unless work train service is provided there can be an appreciable loss in productive working time. Another costly item is the fact that camp equipment can seldom be moved at speeds comparable with other rolling stock. When long distances are involved this can create a problem.

For large gangs of say 50 or 100 men the on-track camp will probably continue to be used, but for the crew of 8 or 10 men which appears to be the average for a B&B crew, or for the still smaller water-service gang, it is beginning to appear that trailer-type housing is going to be the answer to a tough problem. A gang so housed can be moved

from one location to another at any time and on a moment's notice. With a large gang having several housing units it might be necessary to obtain additional towing trucks, but this could probably be taken care of quite easily by using other trucks in the district.

The ability to spot house trailers at any convenient location in the vicinity of the job site is an important argument in selling the desirability of such equipment. Unproductive travel time is practically eliminated although trailers are dependent to some extent on water and electrical connections if they remain in one place for an extended period of time.

There are two general types of trailers that are readily adaptable for use in railroad service. These are the self-contained trailer and the special-purpose trailer.

The self-contained trailer has in a single unit all of the facilities necessary for carrying out the basic activities of cooking, eating, sleeping and washing. Since the size of trailers is limited by state regulations the self-contained trailer usually is suitable for housing a maximum of five men. In some states this number of men in any one unit may have to be further reduced because of laws requiring a certain number of cubic feet of space per man. Equipment of this type is most suitable for the water-service gang and the small B&B maintenance or repair crew who travel from location to location doing minor repair jobs. As these crews usually have been provided with a truck it is not necessary to purchase additional equipment to move the trailer.

While there are several types of trailers on the market, the equipment suitable for railroad service is usually about 8 ft. wide by 22 ft. long. It contains bunk beds, lockers, lavatory, toilet, shower, hot-water heater, water-storage tank, refrigerator, heating unit, cook stove, sink, cabinets, chairs and table. Some are also provided with electric generators. This size trailer will house 4 or 5 men comfortably. Trailers of similar design for housing two or three men are a little shorter, usually being about 18 ft. long. At least one railroad has a self-contained trailer 38 ft. long which houses five men.

Special-purpose trailers are used for the larger crews such as the regular size B&B maintenance and construction gang of 8 to 12 men. However, by a proper combination of such trailers a crew of almost any size could be taken care of.

A typical set-up for a camp of 12 men consists of the following:

1. A kitchen trailer 8 ft. x 18 ft. complete with all cooking, refrigeration and storage facilities, and with space at one end for the cook's sleeping quarters. In some cases washing and toilet facilities are also provided.

2. A dining trailer 8 ft. x 18 ft. normally capable of seating 12 men, but which can be expanded to seat 16 to 18 men.

3. Two bunk trailers, 8 ft. x 22 ft. long, each capable of housing 6 men, and each containing bunk beds, toilet and washing facilities and recreation area. By adding an additional bunk trailer the crew can be built up to 18 men.

Other combinations can be worked out, as for example, an eight man crew is housed in two units, one consisting of an 8-man dormitory with sanitary facilities and the second, a kitchen, dining and recreation room, or office.

On the basis of reports received from railroads who have put this equipment into service for their maintenance forces, it appears that trailer housing has a bright future in the railroad industry.

Discussion

W. H. Huffman (C&NW), who sponsored this committee, opened the discussion by stating that he believed that trailers were a sign of progress and may be one way of holding down maintenance expenses, as requested by Mr. Newell in his address that morning.

W. B. Throckmorton (CRI&P), stated that he feels that trailers are proving very successful, especially for branch line use, and his road intends to use more of them. A big advantage in their use, he said, is their quick movement from one place to another.

T. M. von Sprecken (SOU), stated that his road has gone into expensive use of trailers. The big advantage, he felt, was in moving the trailers on weekends. Since most of the men have their own automobiles, there is no problem in their getting to the trailers at the new location.

Mr. von Sprecken inquired about sanitary facilities in trailers, and Chairman Perrier stated that the replies he got from the com-

mittee members did not indicate that the sanitary facilities in the trailers were used. The B&B gangs were usually set out in a town and they used the station facilities, he said. The newer units are being provided with toilet facilities, and in some cases with connections to sewers, which would permit trailers to be set out closer to the work site.

W. W. Caines (C&O) asked if the two-man units were fully equipped and self-sufficient, and Mr. Huffman said that they were and that the manufacturers would be willing to revise their standard plans to suit certain conditions. He said he knew of occasions where the doors of the units had been revised to swing outward, and, if they were in the wrong place from the safety viewpoint, the manufacturer has changed his design to fit. Mr. Caines, pointed out that in some towns trailers could not be parked any place except in a trailer park specifically set aside for that purpose. He felt that this feature should be explored before buying many trailers. Another member reported the same trouble.

D. G. Hutchinson (WP) asked how propane gas and water could be obtained in outlying districts. Mr. Huffman stated that these can be shipped in if the supply is ordered early enough. He stated further that this is very important because the men saved money by cooking their own meals. In some instances, oversized tanks must be supplied so that sufficient water will be available for showers and drinking purposes. Mr. von Sprecken stated that if the trailers are parked in a town the men can get water at the depot. If parked away from town it may be necessary to haul water.

J. J. Hancock (DT&I) pointed out that the track gangs on his railroad, which are housed in trailers, are provided with a 500-gal. tank, complete with pump, which are mounted separately on a two-wheel trailer for hauling the necessary water.

Some member from the Northern Pacific stated that in many instances where the trailers were moved by truck, the men ride in the trucks. He wondered if some states did not require buses for the transportation of men. Mr. Huffman stated that his road had quite a few trucks with five men cabs for transporting the men but that they were not permitted to ride in moving trailers.

C. Miller (CMSP&P) stated that some states specify that canopies must be used on the trucks while hauling men. Some states, too, permit only six men in a trailer. He pointed out that some trailers do not have toilet facilities which may lead to some trouble with the villages when the men use the station toilets as the village authorities may insist that the trailers be placed in a trailer park. He stated that he purchased some cab-over-engine trucks to stay within that length specified by some states. Mr. Miller also pointed out that freezing can present another problem because after long trips a service man may have to be called to reset the refrigerator. Mr. Huffman stated that his road also had run into trouble with the refrigerators.

M. H. Ferry (Erie) stated that the state of Pennsylvania requires that permission be secured from the capital before any movement of the trailers can be made over the highways. And when permission is requested, certain information with respect to the exact route that the trailers will take, must be supplied.

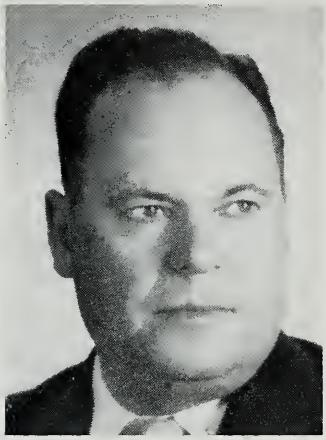
Mr. Miller pointed out that the truck drivers *must* connect the brakes of the trailers with the brakes of the truck before moving them. Also, the trailers must be checked first before moving to see that no men are within them.

Maro Johnson (IC) stated that he thought it would be a good idea to have a committee work up a list of the various state laws so that all members will know just what to observe. Chairman Perrier declared that he thought it would be better to have uniform state laws in regard to trailers and their movement. Mr. Hancock thought the trailer companies themselves may have this information or could get it. Mr. Miller thought otherwise as he stated that he had already written various states and found that the laws differ not only by states but by towns within the states, so that it would be impossible to compile such information.

Prefabricated Buildings Versus Other Types of Construction

Report of Committee

COMMITTEE—H. A. MATTHEWS, *Chairman,* gen. fore. b.& b. & w.s., FRISCO, Amory, Miss.; C. JOHNSTON, *Vice-Chairman,* div. engr., L&N, Birmingham, Ala.; L. H. DAVIS, *Vice-Chairman,* gen. fore., b.& b., AT&SF, Amarillo, Tex.; E. T. CROSS, vice-pres., Armco, Middletown, Ohio; R. L. FLETCHER, struct. engr., Timber Engr., Washington, D.C.; J. A. GOFORTH, maint. engr., Clinchfield, Erwin, Tenn.; J. A. JORLETT, engr. struct., PRR, Baltimore, Md.; J. K. LYNCH, res. mgr., Massey Concrete, Birmingham, Ala.; H. R. PETERSON, ch. engr., NP, St. Paul, Minn.; D. A. RUHL, r.r. engr., U. S. Army, Joliet, Ill.; J. F. WARRENFELLS, asst. div. engr., SAL, Raleigh, N.C.



H. A. Matthews
Chairman

The prefabrication of homes and buildings has made important advancements in the years following World War II. In the early Thirties engineers and builders successfully used prefabricated factory-built items such as windows and window frames, complete doors and frames, siding, roofing and flooring which could be shipped to the job and applied in various ways to old or new structures. Builders (and do-it-yourself carpenters) soon found that the prefab items were time and labor-savers. This idea was extended to include an entire building.

The manufacturers of these structures turned to the auto industry in order to produce their buildings on an assembly line method. Prefab items were assembled in jigs on large tables. This eliminated time lost in measuring and fitting. Each workman became skilled in his own operation and the errors in wasting materials are greatly reduced. The cost of material can be reduced as carload lots of specially sized units are purchased.

The industry has become design conscious and is investing in architectural services and research. They use this as a sales argument advancing the talking points of the architectural design at a low cost as the design costs are spread out over many buildings.

Quality materials will be found, as a rule, is such buildings since inferior grades will foul up precision machinery on assembly lines and cost more in lost man-hours than they save in price.

The panelized building is assembled on a prepared foundation. Included in the panels are cabinets, wiring, hardware, windows, insulation, air-conditioning ducts and finished interior walls. Where permitted, materials are shipped for roughing in of plumbing and the necessary fixtures. Sufficient plans for the foundations and erection of the buildings are furnished.

Metal Buildings

Manufacturers of metal prefabricated buildings offer a line of buildings featuring a wide choice of lengths, widths, heights; arrangements of interior partitions; and sizes of doors, windows and ventilators as well as types and locations. In some instances this is accomplished by standardizing the building units rather than the entire structure. Using these units in multiples, results in wide flexibility and has made it possible to vary the dimensions and details to meet the requirements for buildings of various types, services and locations. Except in the case of unusual requirements or specifications it is possible to get a prefabricated building of one story for most railroad purposes.

Design data and plan information are furnished so that the strength of the parts, the strength of the whole structures, and the expected life of the building can be checked by an experienced builder or designer. The buildings will generally conform to the requirements of the building codes of most municipalities.

Structural framing is available in some types of metal buildings where rolled steel sections are used for columns, beams, trusses, purlins, girts, bracing and framework for windows, doors and other facilities. The components are fastened together with bolts or such types of fasteners which are positive but may be easily removed for dismantling, re-erection, or to permit structural modifications. Welding techniques have brought about the rigid frame design for bents which make possible long spans at less cost than the conventional truss design.

Another design eliminates the structural frame and uses a unique forming of heavy-gauge steel sheets to modular widths. These sheets have a deep interlocked joint. The building is obtainable in the gable-type or leanto-type roof. The rigidity and weather-tightness of the patented joint withstands expansion, contraction and slight unequal settlements.

The buildings can be finished on the interiors with any of the conventional finishing materials. They are usually insulated for economy in heating and comfort in warm weather. The roofs may be ventilated to exhaust objectional fumes or heat. Sometimes skylights are provided. They can be of the conventional type or simply translucent plastic panels fastened in a weathertight frame.

The simplicity of construction and lower construction costs are two features of metal buildings which make them attractive for railroad purposes. Where a conventional building will require skilled workers of several trades such as carpenters, masons, etc., a metal building of the types hereto mentioned can be set up complete and ready for service by a bridge and building force of average skill and ability. This versatility will enable smaller railroads, which do not have building construction gangs, to erect these buildings with regular maintenance forces. Erection can be done without any special tools or power equipment.

Prefabricated metal buildings generally require a lighter and less expensive foundation than conventional buildings. Since they go up faster they can be occupied more quickly. The usual cleanup of waste and clutter after completion of construction is kept to a minimum. The buildings can be erected in any kind of weather; this makes them particularly advantageous in regions having severe winters.

Metal buildings will require careful attention to painting if they are to be wholly satisfactory as far as longevity is concerned. While galvanized and copper-bearing sheets will resist corrosion longer than ordinary uncoated steel sheets, even they are not permanently immune to corrosion. Galvanized surfaces should not be painted until exposure has eliminated the luster which characterizes the new sheets. If it is necessary to paint them immediately following erection for architectural appearances they should be treated with proper materials before applying the protective films.

Because of the light gages of metals usually used it is economical to use only the best grades of metallic paints for the exterior surfaces. A basic pigment that will inhibit rust should be first applied. Dirt, grime and grease should be cleaned away from the metal before coatings are applied. Afterwards it is well to keep grime and grease off the metal coatings.

In the construction of a new large freight yard in the southern part of the country extensive use was made of metal buildings. A storeroom, 40 ft. x 120 ft.; a lumber storage shed 40 ft. x 100 ft.; car-repair shop 80 x 392 ft.; a yard office, wash and locker room 24 ft. x 105 ft.; a diesel shop 61 ft. x 68 ft.; and other smaller buildings were installed by company forces at costs less than estimated for conventional type buildings. This same railroad has built a railroad depot, 24 ft. x 75 ft. of metal. It has also experimented with constructing roadway buildings with removable corners every nine feet. When it is necessary to move the building a nine-foot section is loaded on a flat car and shifted to the new location. Besides the uses mentioned one will find metal buildings used as toolhouses, pumphouses, telephone booths, watch shanties, weigh offices and many other uses. One manufacturer has stated that it has sold over 3,600 buildings to 126 railroads in the past nine years and its present sales are about 500 buildings a year.

The fire-resistant qualities of metal buildings make them desirable at points where

there are fire hazards; at remote points where there is inadequate fire protection; or for the storage of inflammable materials.

Where the question of inside space is an important consideration a metal building in the smaller category will produce from 7 per cent to 12 per cent more floor area than a masonry or wood frame building. This may be important where storage space is required or machinery or electrical equipment is proposed to be used in the structure.

Metal buildings are almost 100 per cent salvageable except for their foundations. This makes it readily adaptable for shifting from one location to another as has been mentioned before, for only a fraction of the cost of retiring and rebuilding a masonry building and most frame buildings. They lend themselves readily to expansion.

Masonry Buildings

Precast concrete buildings of various sizes and designs have been used on American railroads for many years, serving multiple purposes such as equipment houses, material storage houses, gasoline and oil storage facilities, shelters for watchmen, telephone boxes, etc. Some railroads have made increased use of such types of small buildings for housing electrical and signal equipment at CTC controlled switching locations. Being fire, wind and weatherproof they make excellent housing for such equipment which must provide 100 per cent service at all times.

Precasting of concrete buildings is best done at a central casting plant. Here, metallic forms can be used over and over again, affording precision work. Concrete materials are more uniform in character and a specified concrete mixture of designed strength is more likely to be obtained. This is important because wall, roof and floor thicknesses are of thinner cross section than one would likely find if the structure was cast in the field.

Buildings of various sizes up to 6 ft. x 6 ft. and 8 ft. x 12 ft. are cast homogeneously. Door, window and roof-ventilator frames are set in the structure before the concrete is poured. When required, hardware for attaching shelving, panel boards, terminal boards and miscellaneous equipment and attachments are set in place before pouring according to individual needs and specifications. After the concrete has set and the forms are removed the assembly of the various equipment, wiring, placement of doors, windows, etc., is done so that when the structure is shipped it is ready to set down in place.

Because of their weight, the handling and setting of such buildings is most satisfactorily done by a power crane. Lifting attachments are generally incorporated into the roofs of the units. When necessary, however, they can be skidded off a car and lowered or slid into place without too great a difficulty.

The limited maintenance required for masonry buildings tends to offset the differences in initial cost and the cost of handling. Except for some of the metallic parts, it is not necessary to provide any attention for the exterior surfaces, unless it is necessary to apply some moisure resistant compounds to the masonry. The use of non-ferrous materials for frames, doors and other hardware will reduce the amount of maintenance required for them.

New techniques in the development of prestressed members such as slabs, beams, columns and similar members, made out of concrete and high-strength steel wires or rods, holds forth increased possibilities for larger prefabricated masonry buildings. Some of the units will be fabricated at a central casting plant but it is likely the slabs will be cast at the site. Prestressing or poststressing of concrete is the inducing of high compressive stresses in the components by using the wires or rods and jacking equipment. In poststressing the wires and rods are placed in the form and the concrete placed around them. Various means are used to keep the wires and rods free from the concrete mixtures. At the ends of the forms, the wires are carried through plates or through various embedment units so that after the concrete reaches a predetermined strength, jacks are applied to the wires and high stresses put into them. These stresses are transferred as compressive stresses into the concrete. When the loads are reached as determined in the design, the wires are fastened to the plates or embedment units, and the jacks are released.

When the units are put into place and loads applied to them, the tensile forces induced are counterbalanced by the compressive induced forces. By using the high-strength steel wires or rods instead of the conventional reinforcing bars, lighter weights and less steel is required. Smaller units can be designed to carry greater loads.

Several railroad structures using plan concrete panels as well as prestressed concrete

panels have been built the tilt-up method. In some cases the buildings have a structural steel frame and the panels have been designed to fit into the bays. Doors, window frames and other attachments were cast into the panels. In other instances concrete columns have been erected and the tilt-up panels fastened into them. Concrete roof beams and joints, and precast concrete plank roof units form the roof structure. On the concrete planks a smooth surface roof covering was applied.

Prefabricated buildings have entered the railroad field in a big way and in a multiplicity of shapes, materials and designs. The manufacturing companies and the fabricating companies producing them are not standing still on their designs or materials and many railroad officers are finding it worthwhile to investigate the utility and economics of these structures when called upon to provide new building.

Discussion

W. H. Bunge (MP) who sponsored this committee stated that in connection with prefabricated buildings, he has saved five to six weeks of time by putting in the concrete slab before the arrival of the materials.

R. L. Fox (Sou.) asked if prefabricated buildings could be purchased with several floor levels. Mr. Bunge stated that if you have the height, there is no reason why another structure cannot be erected over it.

P. R. Ciccolilli (CRR of NJ) stated that he knew his costs would have been more if he had erected a steel building with his own forces rather than have it down under contract. Another member pointed out that if he could get clearance from the labor organizations, he could save money by contracting the erection work.

Chairman Matthews reported that the prefabricated buildings of today are far different from the ones of the earlier days, and much superior.

H. E. Raver (LI) stated that he believed that aluminized steel will be available in prefabricated structures soon. Mr. Fox stated that, if this were so, it would be one way of getting away from painting work.

J. S. Hancock (DTI) stated that he erected an aluminum station. It makes a very good appearance, he said, and, while it has not been in service for too long a time, he thinks it will be the answer to the painting problem. Another thing about prefabricated buildings, he said, is that they are portable, and maybe the answer for such structures which the mechanical department wants at one place now and later moved to another location.

A member from the Maine Central stated that it was his opinion that the railroads should be able to erect a prefabricated building much cheaper than contractors. He stated that he is now using a packaged window unit, which, while the first cost is expensive, is much less expensive to maintain.

J. W. Rowland (LI) stated that he had set up a small shop for prefabricating the smaller buildings. He said he saved money by not having to send the men out in the field to build these structures. His prefabricated buildings are loaded on trucks and the buildings are easily set up in the field. These structures are also painted in the shop before being sent out, he said. Mr. Fox asked if the metal prefabricated buildings were not cheaper than the wood. Mr. Roland replied that wood is still much cheaper.

Advancements in Protective Coating Systems for Railway Structures

Report of Committee

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W. L. Short
Chairman

Most members of this association are directly concerned with maintenance of the railway industry's plant. They are charged with the responsibility of obtaining maximum plant life at minimum cost. A large portion of the plant consists of various steel structures, most of which require adequate protective coatings to prevent them from becoming unduly ravaged by the environment in which they serve. Railroads, in the most competitive market they have ever faced, find it imperative to re-examine their maintenance programs for more economical means of operation. High labor costs, short protective coating life, and unsatisfactory service are common experiences which make protection expensive.

Unfortunately, structural steel is a material that will corrode readily in many railroad environments. Continuous, concentrated effort is necessary to keep corrosion under control. Acceptance of unnecessary losses or waste from this insidious enemy, with its hidden or indirect effects, is too often tolerated as established custom. The ICC report for 1953 placed the railway industry's corrosion losses at $410,000,000. More than $70,000,000 was charged to M. of W. & structures. Every railroad could benefit from reduction of such losses.

Research on the prevention and control of corrosion has been intensified in recent years. Corrosion is a natural phenomenon which follows its own electro-chemical laws. Corrosion-control systems operate by adjusting the composition of the metal or the environment in which the metal must serve. It is also possible to mitigate corrosion by the use of protective coatings.

Alloy Steels

Up to the present, comparatively little has been accomplished toward a satisfactory solution of the general corrosion problem by improvements in carbon or low-alloy steels. Some advantage is gained through the use of low-alloy steels in certain atmospheric environments through much lower corrosion rates and somewhat longer protective coating life; but little may be gained when such metal is immersed in water or buried in soil. The greatest increase in corrosion resistance to the atmosphere, for unit cost, is achieved by using copperbearing steel. Costly high-alloy steels (such as the stainless family) have been developed; they are applicable for many purposes where their high cost is tolerable. Where such metals are used, design must "tailor" the structure to the requirements of the corrosion resistant material. Much can be done to control corrosion by removing active causes and by the use of improved protective coating systems.

Design

Good design can do a great deal to prevent or minimize corrosion. Consideration should be given to eliminating the necessity for painting by selecting corrosion-resistant materials of construction, reducing exposed areas of metal surfaces to highly corrosive environments, selecting structural shapes and elements that favor easy paint maintenance, eliminating cracks or crevices, using welded joints, avoiding contacts between different materials, providing easy access for inspection and painting of all exposed surfaces, and making certain that all surfaces drain readily and dry quickly.

Protective Coatings

Organic and metallic, as well as other coatings, are used to form a barrier which insulates the metal from corrosive agents of the environment. Many factors, including the kind of service, length of service desired, appearance, environment, surface condition, method of application, labor cost, and economics must be considered in choosing the appropriate type of coating to be used. The major item of expense for painting is usually the cost of application. Generally, it is more economical in the long run to select the best protective coating system available so as to extend the time between paintings.

Too many factors enter into the assessment to permit placing a series of protective coating materials in an exact order of durability. Composition of protective coating material is important, but durability is as much a function of factors outside of composition as of composition itself. For this reason, painting must be viewed as a system designed to include all of the factors involved, such as the composition and condition of the substrata, selection of a coating material most resistant to attack by the environment, application techniques which assure economical protection, etc.

Once an adequate system is applied, the system should be maintained and not permitted to fail prematurely. The investment in surface preparation must be protected by repainting in time. No sound program can be initiated without assigning engineering talent commensurate with the problem and with authority to manage the function. Most painting programs fail because of inadequate information and interest of the supervisory personnel. The crews, sensing this indifference, fail to do their utmost toward obtaining a durable paint system.

Service conditions must be taken into account when selecting a protective coating system for economical protection of a steel structure. Clean bright steel can be exposed to dry atmospheres for long periods of time with little evidence of rusting. Steel surfaces exposed to the interiors of dry buildings (relative humidity below 70 per cent) or structural members incased in masonry or concrete where moisture is excluded fall in this category, and painting for protection alone can hardly be justified. Appearance, however, may often be important.

At normal temperatures, both moisture and oxygen are necessary for corrosion to occur; as the humidity increases, the need for protection increases. At high humidities, and particularly in the presence of chemical agents such as sulphur compounds and salts, the need for good protection becomes imperative. Some in the railway industry are still looking for a panacea and are attempting to do the tough jobs with materials and methods that may be adequate where little or no protection is required, but are worthless in severe environments. Each structure requires individual evaluation, and the paint system should be adequate for both service conditions and the desired results.

Surface Contaminants

Durability of all coatings depends primarily on the condition of the substrate, A blue-colored brittle layer, composed of a mixture of oxides, forms on the hot surfaces of rolled structural steel. This layer of oxides is called mill scale. The composition and thickness of the scale varies, depending on temperature and thickness of the structural shapes as they pass from the rolling mill. Mill scale, when intact, is a satisfactory surface for painting, provided the service conditions do not subject the steel to an environment that acts as a strong electrolyte. Unfortunately, it is generally impossible to keep mill scale from cracking during handling and fabricating operations. Mill scale is cathodic to the underlying steel; upon exposure to weather or moisture, accelerated corrosion occurs at the bottom of the cracks, even though they may be microscopic in size, and the scale is undercut by rust. Generally it is best to specify that new structural steel be shop painted before it is exposed to weather, unless complete removal of mill scale at the site is to be included as part of the protective coating system.

Rust is generally the worst surface contaminant encountered. Removal of rust is

mandatory if the potential life of a quality coating is to be secured. Complete removal of all surface contaminants is expensive. Practical economy dictates the advisability of limiting the expenditure to that sufficient to protect the structure and to satisfy appearance needs. The requirement for such service may be little or no protection, or it may be extensive, costly application of a protective coating system designed for the service.

Steel Structures Painting Manual

The most recent contribution applicable to protecting steel railway structures, to come from organized research, is the "Steel Structures Painting Manual." This manual (comprised of two volumes) has been prepared with the assistance of several hundred specialists and is published by the Steel Structures Painting Council. The Council is composed of representatives from the major steel producers and users in the United States, as well as many prominent organizations in the metallurgical, engineering, and scientific fields including the AAR, AREA, and—now—the ARB&BA.

Volume 1, "Good Painting Practice," is an encyclopedia of comprehensive and detailed information on the theory of corrosion and all the phases of cleaning and painting steel structures, including safety precautions. The subject matter is edited in a manner that all can comprehend.

The second volume, "Systems & Specifications," includes specifications for protective coating systems that have been found to be outstanding in protecting steel structures in nine separate exposure classifications. The specifications are so comprehensively written that they cover almost every service condition and environment in which railway structures must serve. Each paint system is complete; the specifications stipulate the surface preparation, pretreatment, paint application, primers, intermediate and finish paints by reference to separate specifications for each item. Detailed requirements, such as dry paint film thickness, drying time, color contrast between coats, and other necessary information are included. The AREA has adopted most of these specifications as a standard for railway practice; every supervisor responsible for painting steel structure should be fully acquainted with them. Copies are available from the Steel Structures Painting Council, 4400 Fifth Avenue, Pittsburgh 13, Pa.

Surface Preparation

The initial and most important operation in any protective coating system is adequate surface preparation. Surface preparation is required to assure good adhesion or bond of the protective coating to the substrate and to eliminate corrosion stimulators beneath the film. It is mandatory that all loose or noncompatible material that will interfere with good adhesion during the desired service life be removed. Every factor known to have an effect on the desired results should be considered carefully before choosing the appropriate method or methods to be used. The SSPC has issued comprehensive and completely detailed specifications covering nine surface preparation methods which have been found most practical for steel structures.

Hand cleaning or power-tool cleaning, used in conjunction with solvent cleaning, embrace the greatest preponderance of surface preparations for steel structures. This does not necessarily mean that these methods are the most economical when cost is calculated on the amount spent per square foot per year, even though the initial cost is lower and performance may be entirely satisfactory for mild service. Suitable priming paints of good wetting ability must be used over such surfaces.

Flame cleaning, followed by wire brushing and application of a primer with good wetting ability while the surface is still warm, is sometimes used. Flame cleaning removes heavy rust, loose mill scale and some tight mill scale. Paint performance may be somewhat better than over power brushed surfaces due to the dehydration produced by heat. The high cost of the oxygen and acetylene used to produce the intensely hot flame usually limits this method to special cases where problems such as condensation or impossibility of blast cleaning make is advantageous.

Where service conditions require a complete or a high degree of removal of all surface contaminants, either acid pickling or blast cleaning is used. Size of the tank limits pickling to parts or accessories that can be handled in the pickling bath. Blast cleaning is divided into three separate classifications. Brush-off cleaning leaves residues of tight rust and mill scale that may be tolerated by good wetting primers in mild environments. Commercial cleaning leaves lesser residues of tight rust and mill scale that are tolerated by most priming paints even in severe en-

vironments. Cleaning to white metal removes all surface contaminants completely, but this is seldom required for organic coatings in railroad usage.

Weathering is sometimes used to remove mill scale by rusting. Weathering leaves considerable residues of mill scale and rust and must be followed by other cleaning methods. Generally, weathering should not be used unless the structure is to be blast cleaned or mill scale absolutely cannot be tolerated.

Surface Pretreatment

Cleaning processes seldom leave steel surfaces in a satisfactory condition for maximum paint life. For this reason, a number of pretreatment processes have been developed to improve paint adhesion and retard under-film corrosion. Many extravagant claims are made for some pretreatments; particularly those which are advertised to do away with costly surface preparation. Proper pretreatment may be of considerable benefit for severe exposures, such as immersion or chemical environments and is occasionally required for certain primers. The SSPC has issued specifications covering four different pretreatment processes considered most practical for large structures and their components or accessories.

Wetting oil treatment is used over surfaces where it is found impractical to remove all rust and loose or cracked mill scale. Cold phosphate surface treatment is used to passivate steel surfaces that have been thoroughly cleaned of all contaminants. Basic zinc chromate vinyl butyral wash coat or wash primer is used on clean steel surfaces to improve adhesion and retard under-film corrosion. It is sometimes necessary for adhesion of certain vinyl paints. Hot phosphate surface conversion treatment is used to improve paint bond and reduce under-film corrosion to extend paint life on clean steel.

While surface preparation is generally the most critical factor which governs the performance of paints, improper or careless application results in premature failure even over thoroughly clean surfaces. Paints are usually applied to steel structures by brush or spray. Despite the controversy which may exist on the relative merits of each, either method is completely satisfactory if properly done. Any variations between these methods are much less important than those which occur due to negligent workmanship.

Roller coating is a method which has grown considerably during recent years. High production rates approaching that of spraying are possible. The method works best on large smooth surfaces and is particularly useful when spraying cannot be undertaken due to the hazards of over-spray or flammability of solvents.

The factors which govern performance and which must be controlled during paint application are discussed at great length in Volume 1 of the painting manual. The SSPC has issued a paint application specification "Field, Shop & Maintenance Painting" which completely covers all phases of paint storage, mixing, thinning, application by brush or spray, permissible temperatures and humidities, dry film thickness, drying time and protection of freshly painted steel.

Painting Guide

There has long been need for a simple, yet, precise method to specify the complete painting of steel structures in accordance with service requirements. The paint system specifications contained in the SSPC Painting Manual allow the user to refer to the standard paint system by number, just as he would use an ASTM or SAE number in specifying the steel. Any particular aspect such as special cleaning, different finishes, number of coats, etc., that is not included in the standard is covered in a section of alternates.

Oil Base Paint System No. 1 is intended for steel structures exposed to the weather in relatively mild environments such as rural, industrial, or marine atmospheres where the surfaces drain readily and are normally dry. This system embraces the great preponderance of structural steel painting. The minimum surface preparation permitted is hand cleaning or power-tool cleaning. Heavy-duty rust inhibitive primers, based on linseed oil and possessing good wetting ability are specified. The standard system consists of two coats of primer and a finish coat of aluminum, but numerous alternative oil, alkyd, and phenolic intermediate and finish paints are included.

Alkyd Paint System No. 2 is intended for structural steel that is frequently wet, exposed to industrial atmosphere or to high humidity, but not to continuous condensation. It may also be used on surfaces requiring quick-drying paints. Commercial blast cleaning or pickling is required for best results; flame cleaning, power-tool cleaning or hand cleaning may be used with increasingly poorer results. Wetting oil pretreatment is

recommended for areas that cannot be properly cleaned. Alkyd primers, intermediate, and finish paints are specified but phenolic topcoats may be used for very wet environments, or where mild chemical exposure or oil and grease are encountered.

Phenolic Paint System No. 3 is designed for steel surfaces that are continuously immersed in fresh water, occasionally immersed in salt water or exposed to condensation or very humid air. It may also be used for steel exposed to brine drippings, de-icing salts, and wave action. Commercial blast cleaning or pickling is required for best results due to limited wetting of the primers. Flame cleaning, power-tool cleaning, or hand cleaning gives poorer results but may be adequate for maintenance painting. Use of wash primer or hot phosphate pretreatment is recommended for severe service. Inhibitive phenolic primers are used for first and intermediate coats with an aluminum top coat; but oil or alkyd top coats may be used for service above water.

Vinyl Paint System No. 4 is designed to protect structural steel when exposure or service conditions subject it to a chemical environment or one that is a strong electrolyte. Very thorough surface preparation, best obtained by commercial blast cleaning or pickling, is required. Vinyl resin paints are specified; however, inert synthetic resins that are highly resistant to most chemicals and water, such as neoprene, chlorinated rubber, styrene butadiene, silicone, and epoxy are also used in this service. Asphalt and coal-tar mastics are sometimes used for very corrosive atmospheres, but generally are not recommended for immersion. The type of service and chemicals present in the environment must be considered before specific recommendations are made. Synthetic resins will not perform miracles, but they will in a large number of instances prove far superior to the commonly used organic materials in counteracting the action of corrosive chemicals.

Paint System No. 5 is designed to be used on structural steel exposed to severe service, such as frequent immersion in fresh water or sewage, heavy condensation or high humidity, but which cannot economically be pickled or blast cleaned. Hand cleaning or power-tool cleaning is standard for the surface preparation and wetting oil pretreatment is generally beneficial. This system used a red lead-linseed oil primer (used in Paint System No. 1) to which is added 2 lb. of litharge per gallon before use. A zinc dust-zinc oxide-linseed oil primer or a zinc chromate-phenolic primer may be specified. Phenolic intermediate and top coats are used to complete this system.

Paint System No. 6 is designed for use on steel structures that are continuously immersed in salt water or exposed in the splash zone, particularly ships. The standard system for steel immersed in salt water requires blast cleaning or pickling, wash primer pretreatment, four coats of vinyl anti-corrosive paint, and one coat of vinyl anti-fouling paint. A number of alternate systems include alkyd and phenolic for immersed steel, boot-topping, top side, and superstructures. Excellent interior paints, including fire retardant paints are included in this system.

Paint System No. 7 is intended as an economical paint system for structural steel exposed to noncorrosive service such as dry interiors of buildings, temporary protection against weather for short periods, structural members incased in masonry or dry fireproofing, etc. Only a nominal cleaning to remove loose mill scale and rust, weld slag, and heavy deposits of oil, grease and soil is required. The standard shop coat of paint is one coat of iron oxide—ester gum varnish —linseed oil containing some red lead and zinc chromate. An alternate asphalt varnish may be used but is unsuitable as a base for decorative painting.

Paint System No. 8 is intended for use to rustproof structural steel for temporary protection by means of grease or wax-type rust-preventive compounds. Little or no surface preparation is required. Corrosive chemicals, rust scale, soil, etc., should be removed and the coating applied in a thick, heavy film. The soft grease types are easily removed but the harder or pigmented types offer somewhat better resistance to weather and erosion.

Paint System No. 9 may be used to protect structural steel buried in soil. The amount of protection required may vary greatly, depending on soil types and soil resistivity. Generally, it is best to remove all mill scale and rust by blast cleaning or pickling. Asphalt-gilsonite varnishes may be adequate where little protection is needed, but heavy coatings of hot applied coal-tar enamel and wrappings give best results when conditions are severe. These paints are sometimes used for the interiors of ships.

Metallic Coatings

Metallic coatings, such as aluminum, zinc, cadmium, lead, tin, and nickel, may be used

to protect steel from corrosive environments. The less noble metals such as aluminum, zinc or cadmium are effective in mild atmospheres but vary in protective properties when exposed to industrial or marine atmospheres. Sprayed coatings of aluminum and zinc, usually coated with vinyl or other compatible sealers and top coats, are used to protect large structures that cannot be hot dipped. Electroplating of these metals is sometimes used but only light coatings are deposited. Metallic coatings of the more nobel metals such as copper, tin, lead and nickel may be more resistant to initial attack than steel and are used only when application of impervious films by cladding or electroplating is feasible, since any pores or holidays may accelerate corrosion by electrolysis. Surface preparation for such coatings must be thorough and is attained by acid pickling or blasting to white metal. An economical analysis should be made to determine whether a metallic coating will provide lower cost protection than painting.

Summary

Modern research has provided, along with a better understanding of the corrosion processes, new and improved materials, and methods for economical control of this enemy. With these means much could and should be accomplished in reducing the tremendous annual waste or losses presently attributed to corrosion. The selection of the best available protective coating system for a given service requirement, along with adequate supervision to assure proper application and maintenance, are the factors which cannot be overlooked when economical protection is the goal.

Discussion

H. A. Matthews (Frisco) reported that he had used metallic coatings on the top of exposed surfaces of some steel structures. He stated that if the structure was found to need a heavier coating later on the additional material could be added.

M. H. Ferry (Erie) reported that he is painting many structures with a coating containing 45 per cent asphalt suspended in oil. Next year he plans on using 55-per cent asphalt suspended in oil. He stated that he has spray-coated a double-track bridge 50 ft. long in two days. Also, he said, he has had no trouble reported from skin eruptions or injuries to the eyes through the use of these coatings. He thought that he might try to obtain rubberized clothing for some of the men who were engaged in applying this material. Another member rose to say that he had tried that but the men perspired in these suits so much that they did not like them.

J. W. Rowland (LI) asked if the metal is heated when applied to steel structures. He reported that he tried metallic coatings on some tanks and the heating costs were very high. He also reported that he had used a wax pyro paint which has stood up successfully for three years where the ordinary paints do not last one year.

J. V. Inabinet (SAL) reported that he had a bridge over deep sea water in a tide area where the steel was corroding rapidly. He reported that he metallized the members to restore the metal by first sand blasting and keeping the area dry while applying the coat. However, he said, the cost was high and the work did not stand up very well. Four years later he reported that he encased the steel members in concrete for better protection.

Chairman Short stated that he doesn't like to have steel members encased with concrete or with a cement paint applied because the inspector cannot inspect the steel for fatigue failure. He added his road started to metallize its structures in 1936 as an experiment. In 1938 he applied mineralized coatings on several structures in brine territory. But this was an expensive undertaking while the bridge was in actual service. Since 1940, he said, his road has adopted a general policy to coat the top flanges and stringers of open-deck spans whenever a span is being erected or re-erected. He stated that on one job, where 8000 sq. ft. of surface was coated with a metallic coating, the cost ran about $1.12 per sq. ft. While this may seem expensive, he said, the structure is still in excellent condition after 15 years of service and he thinks the expenditure is well worth while.

The Slow Order and Bridge Maintenance and Renewals

Report of Committee

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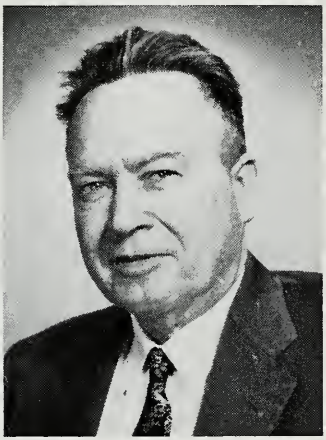

T. M. Von Sprecken
Chairman

In discussing this subject it may be well to reflect first on the basic purpose of maintenance of fixed properties of the railroads in general and of bridge maintenance in particular. It is probably true of the majority of us, who are involved in maintenance, that we get so wrapped up in our problems and the difficulties of carrying them out that we sometimes overlook some of the broader aspects of the business.

The railroad industry is engaged in transportation service. That is the only thing we have to sell. It is the sole reason for our existence. To furnish this service we must have schedules which are fast, sure and dependable. Anything which interferes with this kind of service is an obstacle which must be eliminated or reduced to an absolute minimum if the industry is to prosper. This is necessary if it is to compete on favorable terms with its competitors, and render the service to the nation, of which it is capable, both in times of peace and of war.

In order to maintain service and schedules it is essential that the line and surface of the rails be at all times smooth and supported on safe and firm foundations, adequate for the weight and speed of the trains operated. It is just at this point that we run into trouble. Unfortunately structural materials wear out. The forces of nature get on a rampage and damage the structures. Or maybe, the structure becomes obsolete for any one of a number of causes among which may be mentioned: Designed for loads of a bygone era, located in a place requiring revision to improve speed or safety, or possibly because of government regulations designed to promote navigation.

In order to make the repairs, replacements or other work required, it is sometimes not practicable or economical to do it in such a way as to avoid slowing down the traffic.

If economy were not involved, in most instances a detour could possibly be built which would not involve slow orders. But that is not usually the case. Costs are vital. And it is up to the engineers and maintenance supervisory forces—which means us—to devise means of reducing any delay to the absolute minimum, both in amount and duration.

And right here it may be a good time to emphasize the fact that with the longer trains operated today, it is more important than ever before to avoid slowing or stopping them. On a 150-car train, it takes at least 15 min. to pump off the brakes after stopping. After a stop there is great danger of pulling a drawhead in starting. This factor alone makes slow orders much more serious than they were only a few years ago.

Methods of reducing the number and duration of slow orders falls into three phases:

1. Advance Planning.
2. Preparation.
3. Efficient Execution.

Advance Planning

There is no substitute for intelligent, competent, careful and complete advance plan-

ning. This is the work of the engineers and supervisors. It is probably the most important phase of all. Without a good plan confusion and delay is inevitable.

Planning includes:

A. A method of procedure, detailed step by step. It should be as simple as it is practicable to make it, and it should be thoroughly understood by the foreman.

B. Materials should be ordered in correct quantities and delivery insured by the time they are needed and as they are needed. It is inexcusable to start a job, place a slow order and then get hung up waiting for a vital piece of material. If storage is limited too early delivery of all materials may seriously interfere with the progress of the work.

C. Arrangements must be made to unload and store materials as close to the job site as practicable. And in these days of cut down forces this is often one of the most difficult problems of planning.

D. Camp outfits should be located at or near the site of the work to increase on the job time and thus shorten the slow order period.

E. Consideration should be given to "double shifting," especially during the longer daylight hours of the summer months, which would expedite the work and shorten slow order time. Sometimes a temporary change in assigned hours may be arranged which will permit work in a period of minimum train movements and materially increase working time.

F. If at all possible plan the work so that slow orders may be raised or lifted over week ends and holidays when no work is in progress.

Preparation

The work must be planned so that the maximum amount of work can be done before it is necessary to place a slow order to protect traffic. As an example, a 200-ft. span was rolled out and a new one put in and connected up in 35 min. The preparatory work took weeks but there was no delay to traffic. Other fine examples of this phase of planning are frequently written up in the trade papers. It must be a good feeling to have been connected with some of the outstanding jobs of this kind.

But do not confine your preparatory work to large spectacular jobs. On relatively small jobs the saving of slow order time by careful preparation is proportionately great and the aggregate saving is large.

Last but not least: Check all machinery and other equipment to make sure it is in good working order and adequate for the job in hand. Delays due to breakdowns of equipment may be avoided by careful preparation.

Efficient Execution

This is where the man on the job comes in. The foreman must see to it that each man knows exactly *what* he is to do, *when* he is to do it and *how* he is to do it. There must be no time wasted. Every available minute of "on-track" time must be used.

Cooperation with the transportation people pays big dividends. Talk things over with the trainmasters and dispatchers. Many times they can help materially by adjusting schedules to give a little more "on-track" time. On the other hand feuding with a trainmaster has caused many a job to become fouled up.

Methods of Maintenance to Reduce Slow Order Time—Bridge structures may be broadly divided into steel spans, usually on supports; concrete spans; timber trestles and culverts.

Steel Structures—In making structural repairs to riveted steel spans the use of high strength bolts instead of rivets is increasing and their use speeds the work and shortens time slow orders. It also avoids the need for setting up forges and other equipment for driving rivets. Welding also offers many opportunities for making repairs in a minimum of time. Cranes, mechanical equipment and power tools such as rivet cutters, impact wrenches, drills, spike pullers and drivers, rivet hammers, buckers or "holders on," jacks, gas driven power generators, air compressors and cutting torches should be provided and used. Welding is very efficient, quick and convenient, especially in emergencies. It is generally considered that only electric welding by qualified welders should be permitted on bridge work. It has been noted that there is sometimes a tendency in certain gangs to leave the power tools in the cars and do it the hard way, by hand methods. This should not be permitted.

Timber Decks—When renewing decks, all dimensions and elevations should be checked before the requisitions for materials are made. All ties and guard timbers should be ordered to be cut, bored and dapped before treat-

ment. If the ties are oak or hardwood they may be grooved for rivet heads. This work can be done better and more economically at the mill than on the job site and it expedites the work.

In placing decks, full use should be made of cranes. Light cranes, mounted on heavy duty push cars, and equipped with hoists capable of handling bridge timbers are available where on-track cranes cannot be used. Other cranes on rubber tires are on the market and are coming into use. Some of the newer types have hydraulic controls and are very efficient.

Sometimes the work can be expedited by dropping the old deck timbers to the ground in the clear. One method is to place a ring in one side of the lower portion of the timber hook to which a light line is fastened. When the tie is in the clear a jerk on the rope will free it.

Sometimes it will be advisable to have two heavy duty push cars with the crane, one in front and one behind—the one in front for bringing in the new ties and the one in back for loading the timbers coming out. With large gangs it may pay off to use two cranes —one removing and one placing timbers.

Power tools such as drills, impact wrenches, cut-off saws, together with necessary power for operation should be supplied.

Masonry Structures—In concrete work every effort should be made to locate piers, abutments and other foundations in the clear so that they can be completed as far as practicable before any slow order is required. Where available, use should be made of ready-mixed materials. This avoids elaborate machinery set-ups and track occupancy while unloading aggregate material. On jobs of large size, the use of concrete pumps will be economical and avoid to a large extent the need for slow orders and reduce the time they are needed.

Pneumatically placed concrete repairs to existing masonry structures can usually be made with little or no resort to slow orders.

Timber Trestles and Culverts—In repair of timber trestles, careful planning, advance preparation and use of the many modern tools now available will cut down slow-order time. Among tools needed are power cut-offs, impact wrenches, drills, jacks equipped for pulling drift pins and bolts and light cranes equipped with power pick ups.

On many of the larger pile-driving jobs it will pay off to construct a set-off track or trestle for the pile driver to clear on and thus increase on-track time. One of the crying needs of the times is a design of a timber trestle which can be replaced without lengthy slow orders. Another is the design of a concrete trestle which can replace a timber trestle, with or without track raise, without interfering with traffic. These are challenges to the bridge engineers and designers.

Some railroads have developed practices which greatly minimize interference — the Missouri Pacific among others have developed good methods and organizations. But the use of track pile drivers still interferes with train movements. What is needed is a design which can be completed up to the top of the cap without interfering with traffic or slowing it down in any way.

Culverts—In repair or replacement of culverts, the repair work can usually be done without slow orders. Replacements should wherever possible be done by jacking the new pipe through the fill. If that is impractical the use of tunnel liners is suggested. For large culvert replacements it may be necessary to drive a tunnel. The use of trestle or stringers, and open cut should be avoided, if possible. And it usually can be, if there is sufficient cover between the pipe and the ties.

General—On any of the projects discussed above, whenever possible, the work should be arranged so that the slow order may be lifted or raised over week-ends and holidays when no work is in progress. A little foresight, planning and preparation will greatly help our friends in the operating end of the business.

Communications

One of the greatest aids in reducing slow orders is the recent great development in the field of better communications. A portable field telephone, preferably mounted in a booth at the site, will enable the foreman to keep in touch with the dispatcher (in accordance with some labor agreements, this must be done through an operator). By getting "up to the minute" line ups, the full "on the job" time can be utilized. By increasing "on track" time the work is advanced and the duration of the slow order shortened.

In the last few years radio communication systems have been greatly improved and put

to use in transportation service and are now being used in maintenance work. Some roads have all locomotives and cabs equipped with radio sets. Bridge gangs are being equipped with radio sets tuned to the same frequency. The set-up works as follows:

Slow orders are placed by train order in regular way as required if track and structures cannot be quickly placed in safe condition for full speed. For painting or greasing steel structures no slow orders are used.

"Conditional stop" boards are placed each side of the work; "approach prepared to stop" boards are placed some two miles beyond the "conditional stop" boards; all trains are given a train order notifying the crew that work is under way between M. P. ——— and M. P. ——— and that a positive stop must be made at the conditional stop board unless the engineer receives advice in person or by radio from Foreman ——— ——— (named in the order), that the track is clear and he may proceed.

This enables the gang to work safely without flagmen. The foreman keeps a check on approaching trains. When the train is within 25 to 30 miles, contact can be made and the train's exact location can be determined. Arrangements are made to clear the track and get it in order to pass trains either at full speed or at the speed prescribed in the slow order. When everything is in readiness and in the clear, the foreman notifies the engineer by radio that all is in the clear and of conditions, identifying himself by name. The train is passed with minimum delay. Rarely is a stop required.

Another method of using radio is to equip flagmen with "walkie talkie" sets mounted usually on tripods with antennas to give additional range. The flagman flags until he is notified by the foreman over the walkie talkie that the track is clear for passage of trains. This avoids stopping many long trains and expedites their movement as well as increasing "on track" time and shortening time of slow orders. After the train has passed the foreman notifies the flagman by radio, to resume flagging and only then is the work, which requires the flagging of trains, resumed.

It is certain that many developments and improvements along this line will be made in the near future.

Finally it cannot be emphasized too strongly that while intelligent planning, preparation and execution can greatly minimize the evil of the slow order, *safety is of the first importance in performance of duty* and proper slow orders should be placed to insure it. The slow orders should be kept on as long as there is real need for them. There is no substitute for safety.

Discussion

R. L. Fox (Sou.) asked if there were any railroads which were installing bridge ties in panels. Chairman von Sprecken stated that he did not know of any. However a member from the CRI&P stated that his road installed ties in panels on steel decks.

J. A. Lewis (NYC) stated that he makes panels of ties, complete with spacers, before the old deck is removed, then uses a crane to remove the old panel and, using spreaders, set in the new panels. Mr. Fox asked if the treating plant assembles this material in panels to which Mr. Lewis replied that they did not but that the material arrived mixed from the retort cars.

J. C. Nichols (L&N) stated that all of his ties are made up, treated, marked and shipped out at one time, but are not in panels.

H. D. Curie (B&O) stated that he had torn down stone abutments, keeping them shored up with timber and has replaced them with concrete without ever applying a slow order. Mr. Curie stated that he could not emphasize too much the importance of getting cooperation from the operating department. He cited one instance where the operating department was able to give him the unobstructed use of the track for eight hours which permitted him to complete the job in that time but which would have taken him all week on a piecemeal basis with slow orders. Mr. Nichols stated that he did not believe that the trains should be allowed to proceed over a bridge at a regular speed when abutments are blocked up. He felt that a slow order should be applied even though objections would be heard from the operating department. Mr. Curie replied that he thought that there were a good many instances where it was desirable to spend a little more money for putting in substantial blocking in order to avoid a slow order.

J. T. Roberts (Sou.) stated that there are conditions under which slow orders must be applied, such as for locations where the visibility is restricted. Mr. Curie agreed that where no radio communication was available and where the visibility was greatly restricted, a slow order and flag protection are necessary.

Past Officers

	1891-2	1892-3	1893-4	1894-5
President	O. J. Travis	H. M. Hall	J. E. Wallace	Geo. W. Andrews
1st V.-Pres.	H. M. Hall	J. E. Wallace	Geo. W. Andrews	W. A. McGonagle
2nd V.-Pres.	J. B. Mitchell	G. W. Hinman	W. A. McGonagle	L. K. Spafford
3rd V.-Pres.	James Stannard	N. W. Thompson	L. K. Spafford	James Stannard
4th V-Pres.	G. W. Hinman	C. T. Fuller	E. D. Hines	Walter G. Berg
Secretary	C. W. Gooch	S. F. Patterson	S. F. Patterson	S. F. Patterson
Treasurer	George M. Reid	George M. Reid	George M. Reid	George M. Reid
Executive Members	W. R. Damon	G. W. Andrews	Q. McNab	James Stannard
	G. W. Markley	J. M. Staten	A. S. Markley	James H. Travis
	W. A. McGonagle	J. M. Caldwell	Floyd Ingram	J. H. Cummin
	C. W. McGehee	Q. McNab	James Stannard	R. M. Peck
	G. W. Turner	Floyd Ingram	James H. Travis	J. L. White
	J. E. Wallace	A. S. Markley	J. H. Cummin	A. Shane

	1895-6	1896-7	1897-8	1898-9
President	W. A. McGonagle	James Stannard	Walter G. Berg	J. M. Cummin
1st V.-Pres.	L. K. Spafford	Walter G. Berg	J. H. Cummin	A. S. Markley
2nd V.-Pres.	James Stannard	J. H. Cummin	A. S. Markley	C. C. Mallard
3rd V.-Pres.	Walter G. Berg	A. S. Markley	G. W. Hinman	W. A. Rogers
4th V.-Pres.	J. H. Cummin	R. M. Peck	C. C. Mallard	J. M. Staten
Secretary	S. F. Patterson	S. F. Patterson	S. F. Patterson	S. F. Patterson
Treasurer	George M. Reid	N. W. Thompson	N. W. Thompson	N. W. Thompson
Executive Members	R. M. Peck	W. O. Eggleston	G. J. Bishop	Wm. S. Danes
	J. L. White	W. M. Noon	C. P. Austin	J. H. Markley
	A. Shane	J. M. Staten	M. Riney	W. O. Eggleston
	A. S. Markley	G. J. Bishop	Wm. S. Danes	R. L. Heflin
	W. M. Noon	C. P. Austin	J. H. Markley	F. W. Tanner
	J. M. Staten	M. Riney	W. O. Eggleston	A. Zimmerman

	1899-1900	1900-1901	1901-1902	1902-1903
President	Aaron S. Markley	W. A. Rogers	W. S. Danes	B. F. Pickering
1st V.-Pres.	W. A. Rogers	W. S. Danes	B. F. Pickering	C. C. Mallard
2nd V.-Pres.	J. M. Staten	B. F. Pickering	A. Shane	A. Shane
3rd V.-Pres.	Wm. S. Danes	A. Shane	A. Zimmerman	A. Zimmerman
4th V.-Pres.	B. F. Pickering	A. Zimmerman	C. C. Mallard	A. Montzheimer
Secretary	S. F. Patterson	S. F. Patterson	S. F. Patterson	S. F. Patterson
Treasurer	N. W. Thompson	N. W. Thompson	N. W. Thompson	N. W. Thompson
Executive Members	T. M. Strain	T. M. Strain	A. Montzheimer	W. E. Smith
	R. L. Heflin	H. D. Cleaveland	W. E. Smith	A. W. Merrick
	F. W. Tanner	F. W. Tanner	A. W. Merrick	C. P. Austin
	A. Zimmerman	A. Montzheimer	C. P. Austin	C. A. Lichty
	H. D. Cleaveland	W. E. Smith	C. A. Lichty	W. O. Eggleston
	A. Montzheimer	A. W. Merrick	W. O. Eggleston	J. H. Markley

	1903-1904	1904-1905	1905-1906	1906-1907
President	A. Montzheimer	C. A. Lichty	J. B. Sheldon	J. H. Markley
1st V.-Pres.	A. Shane	J. B. Sheldon	J. H. Markley	R. H. Reid
2nd V.-Pres.	C. A. Lichty	J. H. Markley	R. H. Reid	J. P. Canty
3rd V.-Pres.	J. B. Sheldon	R. H. Reid	R. C. Sattley	H. Rettinghouse
4th V.-Pres.	J. H. Markley	R. C. Sattley	J. P. Canty	F. E. Schall
Secretary	S. F. Patterson	S. F. Patterson	S. F. Patterson	S. F. Patterson
Treasurer	C. P. Austin	C. P. Austin	C. P. Austin	C. P. Austin
Executive Members	R. H. Reid	W. O. Eggleston	H. Rettinghouse	W. O. Eggleston
	W. O. Eggleston	A. E. Killam	A. E. Killam	A. E. Killam
	A. E. Killam	H. Rettinghouse	J. S. Lemond	J. S. Lemond
	R. C. Sattley	J. S. Lemond	C. W. Richey	C. W. Richey
	H. Rettinghouse	W. H. Finley	H. H. Eggleston	H. H. Eggleston
	J. S. Lemond	C. W. Richey	F. E. Schall	B. J. Sweatt

	1907-1908	1908-1909	1909-1910	1910-1911
President	R. H. Reid	J. P. Canty	H. Rettinghouse	H. Rettinghouse
1st V.-Pres.	J. P. Canty	H. Rettinghouse	J. S. Lemond	F. E. Schall
2nd V.-Pres.	H. Rettinghouse	F. E. Schall	F. E. Schall	A. E. Killam
3rd V.-Pres.	F. E. Schall	J. S. Lemond	A. E. Killam	J. N. Penwell
4th V.-Pres.	W. O. Eggleston	A. E. Killam	J. N. Penwell	L. D. Hadwen
Secretary	S. F. Patterson	S. F. Patterson	C. A. Lichty	C. A. Lichty
Treasurer	C. P. Austin	C. P. Austin	J. P. Canty	J. P. Canty
Executive Members	A. E. Killam	J. N. Penwell	W. Beahan	T. J. Fullem
	J. S. Lemond	Willard Beahan	F. B. Scheetz	G. Aldrich
	C. W. Richey	F. B. Scheetz	L. D. Hadwen	P. Swenson
	T. S. Leake	W. H. Finley	T. J. Fullem	G. W. Rear
	W. H. Finley	L. D. Hadwen	G. Aldrich	W. O. Eggleston
	J. N. Penwell	T. J. Fullem	P. Swenson	W. F. Steffens

	1911-1912	1912-1913	1913-1914	1914-1915
President	F. E. Schall	A. E. Killam	J. N. Penwell	L. D. Hadwen
1st V.-Pres.	A. E. Killam	J. N. Penwell	L. D. Hadwen	G. Aldrich
2nd V.-Pres.	J. N. Penwell	L. D. Hadwen	G. Aldrich	G. W. Rear
3rd V.-Pres.	L. D. Hadwen	T. J. Fullem	G. W. Rear	C. E. Smith
4th V.-Pres.	T. J. Fullem	G. Aldrich	C. E. Smith	E. B. Ashby
Secretary	C. A. Lichty	C. A. Lichty	C. A. Lichty	C. A. Lichty
Treasurer	J. P. Canty	J. P. Canty	J. P. Canty	F. E. Weise
Executive Members	G. Aldrich	G. W. Rear	W. F. Steffens	W. F. Steffens
	P. Swenson	W. F. Steffens	E. B. Ashby	S. C. Tanner
	G. W. Rear	E. B. Ashby	S. C. Tanner	Lee Jutton
	W. F. Steffens	C. E. Smith	Lee Jutton	F. F. Strouse
	E. B. Ashby	S. C. Tanner	W. F. Strouse	C. R. Knowles
	W. O. Eggleston	Lee Jutton	C. R. Knowles	A. Ridgway

	1915-1916	1916-1917	1917-1918	1918-1919
President	G. W. Rear	C. E. Smith	S. C. Tanner	Lee Jutton
1st V.-Pres.	C. E. Smith	E. B. Ashby	Lee Jutton	F. E. Weise
2nd V.-Pres.	E. B. Ashby	S. C. Tanner	F. E. Weise	W. F. Strouse
3rd V.-Pres.	S. C. Tanner	Lee Jutton	W. F. Strouse	C. R. Knowles
4th V.-Pres.	Lee Jutton	F. E. Weise	C. R. Knowles	A. Ridgway
Sec.-Treas.	C. A. Lichty	C. A. Lichty	C. A. Lichty	C. A. Lichty
Executive Members	F. E. Weise	W. F. Strouse	A. Ridgway	J. S. Robinson
	W. F. Strouse	C. R. Knowles	J. S. Robinson	J. P. Wood
	C. R. Knowles	A. Ridgway	J. P. Wood	A. B. McVay
	A. Ridgway	J. S. Robinson	D. C. Zook	J. H. Johnston
	J. S. Robinson	J. P. Wood	A. B. McVay	E. T. Howson
	J. P. Wood	D. C. Zook	J. H. Johnston	C. W. Wright

	1919-1920	1920-1921	1921-1922	1922-1923
President	F. E. Weise	W. F. Strouse	C. R. Knowles	Arthur Ridgway
1st V.-Pres.	W. F. Strouse	C. R. Knowles	A. Ridgway	J. P. Wood
2nd V.-Pres.	C. R. Knowles	A. Ridgway	J. S. Robinson	J. S. Robinson
3rd V.-Pres.	A. Ridgway	J. S. Robinson	J. P. Wood	C. W. Wright
4th V.-Pres.	J. S. Robinson	J. P. Wood	C. W. Wright	E. T. Howson
Sec.-Treas.	C. A. Lichty	C. A. Lichty	C. A. Lichty	C. A. Lichty
Asst. Sec.			F. E. Weise	F. E. Weise
Directors	J. P. Wood	C. W. Wright	E. T. Howson	F. C. Baluss
	A. B. McVay	A. B. McVay	J. H. Johnston	Maro Johnson
	J. H. Johnston	G. A. Manthey	E. K. Barrett	O. F. Dalstrom
	E. T. Howson	E. T. Howson	F. C. Baluss	S. D. Corey
	C. W. Wright	J. H. Jonhston	Maro Johnson	W. B. Hotson
	G. A. Manthey	E. K. Barrett	O. F. Dalstrom	P. N. Nelson

	1923-1924	1924-1925	1925-1926	1926-1927
President	J. S. Robinson	J. P. Wood	C. W. Wright	E. T. Howson
1st V.-Pres.	J. P. Wood	C. W. Wright	E. T. Howson	F. C. Baluss
2nd V.-Pres.	C. W. Wright	E. T. Howson	F. C. Baluss	Maro Johnson
3rd V.-Pres.	E. T. Howson	F. C. Baluss	Maro Johnson	J. S. Huntoon
4th V.-Pres.	F. C. Baluss	Maro Johnson	J. S. Huntoon	C. S. Heritage
Sec.-Treas.	C. A. Lichty	C. A. Lichty	C. A. Lichty	C. A. Lichty
Asst. Sec.	F. E. Weise	F. E. Weise	F. E. Weise	F. E. Weise
Directors	S. T. Corey	J. S. Huntoon	C. S. Heritage	A. I. Gauthier
	W. B. Hotson	A. I. Gauthier	W. B. Hotson	E. L. Sinclair
	P. N. Nelson	E. L. Sinclair	P. N. Nelson	O. F. Dalstrom
	J. S. Huntoon	C. S. Heritage	A. I. Gauthier	W. T. Krausch
	A. I. Gauthier	W. B. Hotson	E. L. Sinclair	R. C. Bardwell
	E. L. Sinclair	P. N. Nelson	O. F. Dalstrom	H. I. Benjamin

	1927-1928	1928-1929	1929-1930	1930-1934
President	F. C. Baluss	Maro Johnson	J. S. Huntoon	C. S. Heritage
1st V.-Pres.	Maro Johnson	J. S. Huntoon	C. S. Heritage	A. I. Gauthier
2nd V.-Pres.	J. S. Huntoon	C. S. Heritage	A. I. Gauthier	H. I. Benjamin
3rd V.-Pres.	C. S. Heritage	A. I. Gauthier	H. I. Benjamin	W. T. Krausch
4th V.-Pres.	A. I. Gauthier	H. I. Benjamin	W. T. Krausch	T. H. Strate
Sec.-Treas.	C. A. Lichty	C. A. Lichty	C. A. Lichty	C. A. Lichty
Asst. Sec.	F. E. Weise	F. E. Weise		
Directors	W. T. Krausch	R. C. Henderson	G. A. Rodman	E. C. Neville
	R. C. Bardwell	J. S. Ekey	W. A. Batey	H. H. Best
	H. I. Benjamin	T. H. Strate	F. W. Hillman	J. E. King
	R. C. Henderson	G. A. Rodman	E. C. Neville	A. B. Scowden
	T. H. Strate	W. A. Batey	H. H. Best	W. A. Batey
	J. S. Ekey	F. W. Hillman	J. E. King	L. C. Smith

	1934-1935	1935-1936	1936-1937	1937-1938
President	H. I. Benjamin	T. H. Strate	E. C. Neville	C. M. Burpee
1st V.-Pres.	T. H. Strate	E. C. Neville	C. M. Burpee	F. H. Masters
2nd V.-Pres.	E. C. Neville	C. M. Burpee	F. H. Masters	W. S. Lacher
3rd V.-Pres.	A. B. Scowden	F. H. Masters	C. A. J. Richards	C. A. J. Richards
4th V.-Pres.	W. R. Roof	C. A. J. Richards	W. S. Lacher	F. H. Cramer
Sec.-Treas.	C. A. Lichty	C. A. Lichty	C. A. Lichty	C. A. Lichty
Directors	C. M. Burpee	A. L. McCloy	W. R. Roof	B. R. Meyers
	W. A. Batey	R. P. Luck	T. P. Soule	G. S. Crites
	L. C. Smith	H. H. Best	F. H. Cramer	R. E. Dove
	C. A. J. Richards	W. R. Roof	B. R. Meyers	T. P. Soule
	A. L. McCoy	T. P. Soule	G. S. Crites	A. Chinn
	R. P. Luck	F. H. Cramer	R. E. Dove	L. G. Byrd

	1938-1939	1939-1940	1940-1941	1941-1942
President	Armstrong Chinn	A. E. Bechtelheimer	H. M. Church	R. E. Dove
1st V.-Pres.	F. H. Cramer	F. H. Cramer	R. E. Dove	F. H. Soothill
2nd V.-Pres.	A. E. Bechtelheimer	H. M. Church	F. A. Soothill	G. S. Crites
3rd V.-Pres.	H. M. Church	R. E. Dove	G. S. Crites	A. M. Knowles
4th V.-Pres.	R. E. Dove	F. H. Soothill	A. M. Knowles	N. D. Howard
Sec.-Treas.	C. A. Lichty	C. A. Lichty		
Secretary			F. O. Whiteman	A. G. Shaver
Treasurer			F. E. Weise	F. E. Weise
Directors	L. G. Byrd	B. R. Meyers	N. D. Howard	R. E. Caudle
	W. R. Ganser	W. Walkden	L. G. Byrd	I. A. Moore
	F. H. Soothill	A. S. Krefting	K. L. Miner	W. A. Sweet
	B. R. Meyers	A. M. Knowles	R. E. Caudle	J. L. Varker
	W. Walkden	L. G. Byrd	I. A. Moore	L. E. Peyser
	A. S. Krefting	K. L. Miner	W. A. Sweet	Martin Meyer

	1942-1943	1943-1944	1944-1945	1945-1946
President	G. S. Crites	J. L. Varker	J. L. Varker	N. D. Howard
1st V.-Pres.	R. E. Caudle	R. E. Caudle	R. E. Caudle	F. G. Campbell
2nd V.-Pres.	A. M. Knowles	N. D. Howard	N. D. Howard	J. S. Hancock
3rd V.-Pres.	N. D. Howard	F. G. Campbell	F. G. Campbell	E. H. Barnhart
4th V.-Pres.	J. L. Varker	J. S. Hancock	J. S. Hancock	W. F. Martens
Secretary	A. G. Shaver† Lorene Kindred‡ Elinor V. Heffern	Elinor V. Heffern	Elise LaChance	Elise LaChance
Treasurer	F. E. Weise	C. R. Knowles	C. R. Knowles	C. R. Knowles
Treasurer Emeritus		F. E. Weise	F. E. Weise	
Directors	M. Meyer	W. F. Martens	W. F. Martens	A. B. Chapman
	L. E. Peyser	A. L. McCloy	A. L. McCloy	W. A. Huckstep
	K. L. Miner	L. C. Winkelhaus	L. C. Winkelhaus	F. R. Spofford
	F. G. Campbell	E. H. Barnhart	E. H. Barnhart	Guy E. Martin
	J. S. Hancock	A. B. Chapman	A. B. Chapman	B. R. Meyers
	L. C. Winkelhaus	L. E. Peyser	L. E. Peyser	L. E. Peyser

†To November 1, 1942
‡To February 1, 1943

	1946-1947	1947-1948	1948-1949	1949-1950
President	F. G. Campbell	J. S. Hancock	E. H. Barnhart	W. F. Martens
1st V.-Pres.	J. S. Hancock	E. H. Barnhart	W. F. Martens	W. A. Huckstep
2nd V.-Pres.	E. H. Barnhart	W. F. Martens	W. A. Huckstep	Guy E. Martin
3rd V.-Pres.	W. F. Martens	W. A. Huckstep	Guy E. Martin	F. R. Spofford
4th V.-Pres.	W. A. Huckstep	G. E. Martin	F. R. Spofford	Lee Mayfield
Secretary	Elise LaChance	Elise LaChance	Elise LaChance	Elise LaChance
Treasurer	C. R. Knowles	C. R. Knowles	L. C. Winkelhaus	L. C. Winkelhaus
Directors	Guy E. Martin	H. M. Harlow	Lee Mayfield	H. M. Harlow
	B. R. Meyers	H. B. Christianson	F. M. Misch	V. E. Engman
	L. E. Peyser	F. R. Spofford	W. D. Gibson	G. W. Benson
	H. M. Harlow	Lee Mayfield	H. M. Harlow	F. M. Misch
	H. B. Christianson	Franz M. Misch	V. E. Engman	L. R. Morgan
	F. R. Spofford	W. D. Gibson	G. W. Benson	J. A. Jorlett

	1950-1951	1951-1952	1952-1953	1953-1954
President	W. A. Huckstep	Guy E. Martin	F. R. Spofford	Lee Mayfield
1st V.-Pres.	Guy E. Martin	F. R. Spofford	Lee Mayfield	H. M. Harlow
2nd V.-Pres.	F. R. Spofford	Lee Mayfield	H. M. Harlow	J. A. Jorlett
3rd V.-Pres.	Lee Mayfield	H. M. Harlow	J. A. Jorlett	R. R. Gunderson
4th V.-Pres.	H. M. Harlow	J. A. Jorlett	R. R. Gunderson	W. H. Huffman
Secretary	Elise LaChance	Elise LaChance	Elise LaChance	Elise LaChance
Treasurer	L. C. Winkelhaus	L. C. Winkelhaus	L. C. Winkelhaus	L. C. Winkelhaus
Directors	F. M. Misch	M. H. Dick	W. H. Huffman	M. H. Dick
	L. R. Morgan	R. R. Gunderson	L. R. Morgan	J. F. Warrenfells
	J. A. Jorlett	J. F. Warrenfells	B. M. Stephens	G. Switzer
	M. H. Dick	W. H. Huffman	M. H. Dick	B. M. Stephens
	R. R. Gunderson	L. R. Morgan	J. F. Warrenfells	W. H. Bunge
	J. F. Warrenfells	B. M. Stephens	G. Switzer	E. R. Schlaf

	1954-1955	1955-1956
President	H. M. Harlow	J. A. Jorlett
1st V.-Pres.	J. A. Jorlett	R. R. Gunderson
2nd V.-Pres.	R. R. Gunderson	W. H. Huffman
3rd V.-Pres.	W. H. Huffman	M. H. Dick
4th V.-Pres.	M. H. Dick	B. M. Stephens
Secretary	Elise LaChance	Elise LaChance
Treasurer	L. C. Winkelhaus	L. C. Winkelhaus
Directors	B. M. Stephens	J. F. Warrenfells
	W. H. Bunge	H. D. Curie
	E. R. Schlaf	J. M. Lowry
	J. F. Warrenfells	W. H. Bunge
	H. D. Curie	E. R. Schlaf
	J. M. Lowry	G. W. Benson

CONSTITUTION

ARTICLE I.

NAME

Section 1. This association shall be known as the American Railway Bridge & Building Association.

ARTICLE II.

OBJECT

Section 1.** The object of this association shall be the advancement of knowledge pertaining to the design, construction and maintenance of railway bridges, buildings, water service facilities, and other structures, by investigation, reports and discussions.

Section 2. The association shall neither indorse nor recommend any particular devices, trade marks or materials, nor will it be responsible for any opinions expressed in papers, reports or discussions unless the same have received the endorsement of the association in regular session.

ARTICLE III.

MEMBERSHIP

Section 1. The membership of this association shall be divided into five classes, viz: Members, life members, associate, honorary and junior members.*

Section 2.** A member shall be a person in a position above rank of gang foreman in connection with railway bridge, building and water service work. Any person desirous of becoming a member shall make application upon the form prescribed by the executive committee, setting forth his name, age, residence and practical experience. He shall furnish at least three references to whom he is personally known. Applicants may be voted into membership at any regular executive meeting or by letter ballot of the executive committee, a majority vote being necessary in either instance.

Section 3.** To be eligible for a life membership a member must have belonged to the association for at least twenty years and in general must have retired from active railway service due to age or physical disability. He shall have all the privileges of active membership, except the holding of office, and shall not be required to pay annual dues. The transfer from membership to life membership shall be made in the same manner as the election of members, as prescribed in Section 2, of this Article.

Section 4. Associates shall be responsible persons who are not eligible as members, whose pursuits or attainments qualify them to co-operate with members in the study and development of improved practices in the construction and maintenance of bridges, buildings and water facilities. They shall have all the rights of members except of voting and holding office. They shall be elected in the manner prescribed for members, in Section 2, of this Article.

Section 5. Honorary members shall be chosen from persons who have attained acknowledged eminence in some branch of engineering or railway service. Their number shall be limited to ten. Honorary members shall be proposed by not less than six active members and shall be elected by the unanimous vote of the members present at a regular meeting. They shall have all the rights of active members except that of holding office and shall be exempt from the payment of dues.

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*Amended October 16, 1941.
**Amended September 20, 1948.

Section 6. A junior member shall be a person who is a graduate of a recognized engineering school, or who has been employed for at least two years in the design, maintenance or construction of railway bridges, buildings or structures. Applicants shall be at least 21 years of age and they shall be elected in the manner prescribed for members, in Section 2 of this article. Juniors shall have all the rights of members except that of holding office. When the attainments of a Junior are such as to qualify him as a member, he may apply for promotion and the Executive Committee shall authorize such promotion when qualifications warrant the action. Unless a Junior is promoted, his membership shall cease automatically when he becomes 28 years of age.*

Section 7. Any member guilty of conduct unbecoming to a railroad officer and a member of this association, or who shall refuse to comply with the rules of this association, shall forfeit his membership on a two-thirds vote of the executive committee.

Section 8. Membership shall continue until written resignation is received by the secretary, unless member has been previously expelled, or dropped for non-payment of dues in accordance with Section 1 of Article VII.

Section 9.** Only active members shall hold office in this association, and only active and life members shall be entitled to vote in the election of officers.

ARTICLE IV.

OFFICERS

Section 1. The officers of this association shall be a president, four vice-presidents, a secretary, a treasurer and six directors who with the most recent past president shall constitute the executive committee.

Section 2. The past presidents of this association, previous to the most recent past president, who continue to be members, shall be privileged to attend all meetings of the executive committee, of which meetings they shall receive due notice, and be permitted to discuss all questions and to aid said committee by their advice and counsel; but said past presidents shall not have a right to vote, unless called upon to fill a quorum.

Section 3. Vacancies in any office shall be filled for the unexpired term by the executive committee without delay.

ARTICLE V.

EXECUTIVE COMMITTEE

Section 1.** The executive committee shall manage the affairs of the association and shall have full power to control and regulate all matters not otherwise provided for in the constitution and by-laws and shall exercise general supervision over the financial interests of the association, and make all necessary purchases and contracts required to conduct the general business of the association, but shall not have the power to render the association liable for any debt beyond the amount then in the treasury plus accounts receivable and not subject to other prior liabilities. All appropriations for special purposes must be acted upon at a regular meeting of the association.

Section 2. Meetings of the executive committee may be called by a majority of the members of the committee, providing 10 days' notice is given members by mail.

Section 3. Five members of the executive committee shall constitute a quorum for the transaction of business.

ARTICLE VI.

ELECTION OF OFFICERS AND TENURE OF OFFICE

Section 1. Except as otherwise provided, the officers shall be elected at the regular annual meeting of the association and the election shall not be postponed except by unanimous consent of the members present at said annual meeting. The election shall be by ballot, a majority of the votes cast being required for election. Any active member of the association not in arrears for dues shall be eligible for office, but the president shall not be eligible for reëlection.

*Amended October 16, 1941.

**Amended September 20, 1948.

Section 2.† The president, four vice-presidents, secretary and treasurer shall hold office for one year and the directors for two years, three directors being elected each year. All officers retain their offices until their successors are elected and installed.

Section 3.† The term of office of the secretary and the treasurer may be terminated at any time by a two-thirds vote of the executive committee. Their compensation shall be fixed by a majority vote of the executive committee.

The secretary shall also serve as secretary of the executive committee.

Section 4. The secretary and the treasurer shall be required to give bond in an amount to be fixed by the executive committee.

ARTICLE VII.

MEMBERSHIP FEE AND DUES

Section 1.† Every member upon joining this association shall pay to the secretary an entrance fee and dues as prescribed by the executive committee. No member in arrears for annual dues shall be entitled to vote at any election and any member more than one year in arrears may be stricken from the list of members at the discretion of the executive committee.

ARTICLE VIII.*

LOCAL SECTIONS

Section 1.** Upon the application of ten or more members of the association residing in the same geographical district, or having offices therein, the executive committee shall organize a local section for that district, to which all members in that district shall be eligible. Such local section shall admit to active membership only members in good standing. It shall hold not less than two meetings each year, and shall be governed by such constitution and by-laws not inconsistent with the constitution of this association as the section membership may adopt and the executive committee of the association approve.

Section 2. The parent association shall not be put under any obligation, either financial or in the matter of policy or opinion, by any local section.

ARTICLE IX.

AMENDMENTS

Section 1. This constitution may be amended at any regular meeting by a two-thirds vote of the members present, provided that notice of the proposed amendment or amendments has been sent to the members at least 30 days previous to said regular meeting.

BY-LAWS

TIME OF MEETING

1.** The regular meeting of this association shall convene annually during the month of September, the exact date to be fixed by the Executive Committee.

PLACE OF MEETING

2.** The place of holding the annual convention shall be Chicago, Ill.

3. It shall lie within the power of the executive committee to change the location or time of the meeting if it becomes apparent that it is for the best interests of the association.

QUORUM

4. At the regular meeting of the association, 15 or more members shall constitute a quorum.

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†Amended October 17, 1940.
*Article adopted 1922.
**Amended September 20, 1948.

**DUES

5. The annual dues, for the fiscal year ending August 31, and payable in advance, shall be as follows:*

Members, $5.00; Associate Members, $4.00; Junior Members, $2.50.

DUTIES OF OFFICERS

6.† The president shall have general supervision over the affairs of the association. He shall preside at all meetings of the association and of the executive committee; shall appoint all committees not otherwise provided for, and shall be ex-officio member of all committees. He shall with the secretary sign all contracts or other written obligations of the association which have been approved by the executive committee. He shall render a detailed report at least three times during the year to the members of the executive committee, showing the financial condition of the association and its activities.

At the annual meeting the president shall present a report containing a statement of the general conditions of the association.

7. The vice-presidents in order of seniority shall preside at meetings in the absence of the president and discharge his duties in case of a vacancy in his office.

8.† It shall be the duty of the secretary to keep a correct record of the proceedings of all meetings of this association, and of all accounts, between this association and its members; to collect all moneys due the association, and deposit the same in the name of the association. He shall pay all bills when properly certified and approved by the president and the treasurer, and make such reports as may be called for by the executive committee. He shall also perform such other duties as the association may require.

9.‡ The treasurer shall have charge of the funds, check all deposits as made by the secretary, sign all checks after they have been approved by the president, and invest all funds not needed for current expenses as directed by the executive committee. He shall report at each annual meeting on the condition of the finances.

NOMINATING COMMITTEE

10.♯ After each annual meeting the president shall appoint a committee consisting of five members. Two Past Presidents shall be members of this committee, one of whom shall act as Chairman. No other officers of the Association shall be appointed to this committee. This committee shall prepare a list of names of nominees for officers to be voted on at the next annual convention in accordance with ARTICLE VI of the Constitution, said list to be read at the business session of said convention. Nothing in this section shall be construed to prevent any member making further nominations.

AUDITING COMMITTEE

11.‡ Prior to each annual meeting the president shall appoint a committee of three members, not officers of the association, whose duty it shall be to examine the accounts and vouchers of the secretary and the treasurer and certify as to the correctness of their accounts.

COMMITTEE ON SUBJECTS FOR DISCUSSION

12. After each annual meeting the president shall appoint a committee whose duty it shall be to prepare a list of subjects for investigation to be submitted for approval at the next convention.

COMMITTEE ON INVESTIGATION

13. After the association has adopted the list of subjects for investigation the president for the succeeding year shall appoint the committees who shall prepare the subjects for report and discussion. He may also appoint individual members to prepare reports on special subjects, or to report on any special or particular subject.

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†Amended October 17, 1940.
‡Adopted October 17, 1940.
*Amended October 16, 1941.
**Amended September 20, 1948.
♯Amended December 4, 1950.

PUBLICATION COMMITTEE

14. After each annual meeting the executive committee shall appoint a publication committee consisting of three active members whose duty it shall be to coöperate with the secretary in the issuing of the publications of the association. The assignment of this committee shall be such that at least one member shall have served on the committee during the previous year.

ORDER OF BUSINESS

15.† Call to order by president.
Opening prayer or invocation.
President's address.
Report of secretary.
Report of treasurer.
Appointment of special committees.
Reports of standing committees and presentation of papers.
Unfinished business.
New business.
Election of officers.
Installation of officers.
Adjournment.

DECISIONS

16. The votes of a majority of the members present shall decide any questions, motion or resolution which shall be brought before the association, unless otherwise provided. Unless specifically provided herein otherwise, all discussions shall be governed by Robert's rules of order.

AMENDMENTS

17.† The By-Laws can be amended by a two-thirds vote of those present at any regularly called Executive Committee Meeting.

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†Amended September 20, 1948.

DIRECTORY OF MEMBERS

as of February 1, 1957

(Figure after each name indicates year when member joined the association)

* Indicates Junior Member

HONORARY MEMBERS

Barnhart, E. H. (Retired) Div. Engr., B. & O., St. Petersburg, Fla. (1941)
Bechtelheimer, A. E., (Retired) Br. Engr., C. & N. W., Chicago, Ill. (1920)
Budd, Ralph, (Retired) President, C. B. & Q., Santa Barbara, Calif. (1927)
Buford, C. H., (Retired) President, C. M. St. P. & P., Washington, D. C. (1946)
Chinn, Armstrong, Pres., T. R. R. Assn. of St. L., St. Louis, Mo. (1930)
Crites, G. S., (Retired) Div. Engr., B. & O., Baltimore, Md. (1912)
Howard, N. D., Exec. Sec., A. R. E. A., Chicago, Ill. (1926)
Strate, T. H., (Retired), Div. Engr., C. M. St. P. & P., San Ysidro, Calif. (1918)
Vandenburgh, E. C., (Retired) Ch. Engr., C. & N. W., Chicago, Ill. (1925)

ACTIVE MEMBERS

A

Aaron, J. L., B. & B. Insp., W. M., Cumberland, Md. (1954)
Adkins, H. O., Gen. Supv. B. & B., D. & R. G. W., Denver, Colo. (1953)
Albert, E. A., Steel Bridge Insp., I. C., Chicago, Ill. (1956)
Allen, J. P., Asst. Engr., Sou., Knoxville, Tenn. (1956)
Alley, F. T., Asst. B. & B. Supvr., St. L. S. W., Tyler, Texas (1955)
Anderson, A., Spec. Asst. Engr., N. Y. C., Chicago, Ill. (1947)
Anderson, A. C., Gen. B. & B. For., D. M. & I. R., Two Harbors, Minn. (1952)
Anderson, J. L., Supv. B. & B., M. P., Osawatomie, Kan. (1931)
Armstrong, W. F., Arch'l. Engr., C. & N. W., Chicago, Ill. (1947)
Arniel, W. R., Asst. Supv. Struc., Penna., Pittsburgh, Pa. (1953)
Askew, J. H., B. & B. Supvr., Sou., Atlanta, Ga. (1956)
Atkinson, T. J., Supv. of Struc., Penna., Pittsburgh, Pa. (1947)

B

Babbitt, J. H., Div. Engr., B. & O., Indianapolis, Ind. (1946)
Babcock, D. L., Supv. B. & B., C. & N. W., Fond du Lac, Wis. (1953)
Bach, S. A., Asst. B. & B. Supvr., M. P., Kansas City, Mo. (1955)
Baker, F. A., Asst. Gen. Bridge Insp., S. P., San Francisco, Calif. (1955)
Baker, R. C., Engr. of Struc., C. & E. I., Danville, Ill. (1940)
Baker, W. L., Supvr. W. S. & Wk. Equip., C. & E. I., Salem, Ill. (1956)
Barhan, L. M., Asst. B. & B. Supvr., N. P., Minneapolis, Minn. (1956)
Barr, H. L., Div. Engr., C. & N. W., Boone, Ia. (1938)
Barranco, S. H., Supvr. Str., P. R. R., Richmond, Ind. (1951)
Beam, Y. C., Mast. Carp., S. A. L., Americus, Ga. (1945)
Beaver, J. F., Ch. Engr., M. of W. & Struc., Sou., Charlotte, N. C. (1950)
Benson, G. W., Supt. Br., C. of Ga., Macon, Ga. (1940)
Benson, O. C., Asst. Eng. M. of W., B. & M., Boston, Mass. (1952)
Beringer, M. A., Br. Inspr., I. C., Chicago. Ill. (1929)
Beynon, H. G., B. & B. Mast., C. P., Brandon, Man., Can. (1951)
Billmeyer, E. D., Brdg. & Str. Eng., W. M., Baltimore, Md. (1955)
Bisbee, R. D., Div. Engr., P. & S. F., Slaton, Texas (1947)
Bishop, I. A., Asst. Mast. Carpenter, S. A. L., Jacksonville 11, Fla.
Black, A. R., Sp. Rep., S. P., Houston, Texas (1953)
Blake, J. E., Jr., Asst. Supv. Struc., Penna., Harrisburg, Pa. (1953)
Block, M., Asst. to Ch. Engr., I. C., Chicago, Ill. (1948)
Bober, H., B. & B. Engr., G. M. & O., Mobile, Ala. (1947)
Bodie, B. V., Asst. Vice Pres. & Ch. Eng., G. M. & O., Mobile, Ala. (1951)

Boehling, H. A., Jr., Asst. Supv. B. & B., C. & O., Richmond, Va. (1948)
Boling, E. C., Supv. B. & B., N. S., Cary, N. C. (1950)
Borchert, W. C., Div. Engr., K. C. S., Shreveport, La. (1942)
Born, J. O., Eng. Str., M. C., Portland, Me. (1956)
Bourgasser, A., Supvr. B. & B., C. & I. M., Springfield, Ill. (1956)
Bowman, H. A., Mast. Carp., Ft. W. & D. C., Wichita Falls, Tex. (1953)
Bowman, R. M., Asst. Supvr. Str., P. R. R., Pittsburgh, Pa. (1954)
Brandimarte, J. J., Jr., Supvr. Str., P. R. R., Pittsburgh, Pa. (1947)
Bredfeldt, C., Ch. Drafts., C. M. St. P. & P., Chicago, Ill. (1955)
Brice, W. T., B. & B. Mast., C. N., Regina, Sask., Can. (1946)
Broome, W. S., Asst. Ch. Engr., C. & S., Ft. W. & D., Denver, Colo. (1954)
Brouse, R. G., Mast. Carp., C. B. & Q., Chicago, Ill. (1951)
Browder, J. G., Asst. Engr., Southern, Charlotte, N. C. (1955)
Brown, E. J., Ch. Engr., C. B. & Q., Chicago, Ill. (1955)
Brown, G. A., Gen. Fore., B. & B., A. T. & S. F., Wellington, Kan. (1953)
Brown, G. W., Water Serv. Supvr., T. & N. O., Houston, Texas (1955)
Brown, K. R., B. & B. Supvr., C. & E. I., Salem, Ill. (1956)
Brown, L. W., B. & B. Supv., C. & O., Peru, Ind. (1951)
Bruns, M. W., Brdg. Eng., T. R. R. A. of St. L., St. Louis, Mo. (1954)
Buckmaster, W. A., Asst. Div. Engr., B. & O. C. T., Chicago, Ill. (1951)
Budzenski, F. N., Gen. Fore., C. & N. W Antigo, Wis. (1938)
Bunch, A. H., Asst. Gen. Fore. B. & B. & W. S., St. L.-S. F., Ft. Scott, Kans. (1951)
Bunge, W. H., Asst. Eng., M. P., St. Louis, Mo. (1941)
Burch, E. E., Br. Engr., C. M. St. P. & P., Chicago, Ill. (1945)
Burford, A. E., Gen. For. B. & B., I. C., Memphis, Tenn. (1947)
Burkel, J. N., Draftsman, M. P., St. Louis, Mo. (1951)
Burner, P. D., Asst. Gen. Supv. Struc. & Wk. Eqpt., W. P., Oakland, Calif. (1953)
Burrows, C. D., Mast. Carp., B. & O., Wilmington, Del. (1946)
Bush, R. H., W. S. Supv., T. & N. O., Ennis, Tex. (1952)

C

Caines, W. W., Supv. B. & B., C. & O., Huntington, W. Va. (1938)
Camelle, E. J., Asst. B. & B. Supv., T. & N. O., Houston, Tex. (1954)
Cameron, W. M., Ch. Carp., C. M. St. P. & P., Madison, Wis. (1955)
Campbell, H. G. Jr., Asst. Supvr. Str., P. R. R., Canton, Ohio (1956)
Campbell, J. A., Supvr. Str., PRR, New York, N. Y. (1951)
Campbell, J. E., Gen. Supv. M. of W. S. Weld., W. P., Lafayette, Calif. (1954)
Cantrell, C. F. Jr., B. & B. Gen. Fore., I. C., Vicksburg, Miss. (1956)
Carlson, A. W., Engr. of Brdg. & Str., W. P., San Francisco, Calif. (1955)
Carothers, M. D., Asst. Ch. Engr., G. M. & O., Bloomington, Ill. (1938)
Carpenter, R. H., Dist. Eng., M. P., Little Rock, Ark. (1956)
Carter, J. W., B. & B. Supv., Virginian, Roanoke, Va. (1947)
Carter, T. S., Ch. Eng., M. K. T., Dallas Texas (1954)
Cary, J. R. III, Asst. Tr. Mast., C. & O., Peru, Ind. (1954)
Cary, N. M., Div. Engr., Sou., Valdosta, Ga. (1953)
Cash, E. E., Supv. M. W., Camas Prairie, Lewiston, Idaho (1953)
Chaffin, E. S., Supv. B. & B., N. & W., Crewe, Va. (1954)
Chamberlain, H. L., Supvr. Str., P. R. R., Harrington, Del. (1956)
Chamberlain, P. C., Asst. to Engr. of Struc., Erie, Cleveland, Ohio (1941)
Chaney, A. B., Eng. M. of W., M. P., St. Louis, Mo. (1947)
Cheney, R. R., Asst. Supvr., Br. Mtce., C. M. St. P. & P., Chicago, Ill. (1953)
Cheselski, F. S., Asst. Mast. Carp., G. N., Grand Forks, N. D. (1956)
Christianson, H. B., Asst. Ch. Engr. Sys., C. M. St. P. & P., Chicago, Ill. (1928)
Clapper, K., Gen. Fore. B. & B., D. M. & I. R., Proctor, Minn. (1953)
Clark, K. L., Prin. Asst. Engr., C. M. St. P. & P., Chicago, Ill. (1939)
Clarke, R. J., Eng. Str., P. R. R., Cincinnati, Ohio (1956)
Clise, W. E., Supv. B. & B., W. M., Frostburg, Md. (1953)
Clouette, H. F., Asst. B. & B. Supv., N. W. P., San Rafael, Calif. (1953)
Cole, G., B. & B. Gen. For., A. T. & S. F., Burlingame, Kan. (1949)
Collier, P. B., Supt. of Scales, M. P., St. Louis, Mo. (1938)
Collings, J. E., Ch. Carp., C. M. St. P. & P., Savanna, Ill. (1953)
Collum, R. L., Mast. Carp., S. A. L., Jacksonville, Fla. (1941)
Colvin, A. A. (Ret.), Div. Engr., C. & N. W., Norfolk, Nebr. (1937)
Colvin, C. S., Asst. Engr. of Str., I. G. N., Houston, Tex. (1951)
Converse, D. W., Br. Engr. A. C. & Y., Akron, Ohio (1940)
Cook, E. F., W. S. For., M. P., Little Rock, Ark. (1947)
Cooledge, V. R., Engr. of Br., S. P., San Francisco, Calif. (1953)
Corbett, R. K., Asst. Gen. Fore., A. T. & S. F., San Bernardino, Calif. (1956)

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Corporon, F. J., Supt. W. & Struc., C. S. S. & S. B., Michigan City, Ind. (1950)
Cox, R. C., B. & B. Supv., W. P., Sacramento, Calif. (1950)
Cox, W. R., Div. Engr., S. A. L., Americus, Ga. (1954)
Creed, T. F., Jr., Res. Engr. Bridge Dept., Sou., Washington, D. C. (1954)
Crespo, M. J., Asst. Design Engr., W. P., San Francisco, Calif. (1956)
Crews, C. H., Supv. B. & B., I. C., Jackson, Tenn. (1947)
Croft, P. H., Asst. Engr. M. of W., I. C., Memphis, Tenn. (1947)
Crouch, H. M., Wtr. Serv. Supv., T. & P., Bunkie, La. (1954)
Crounse, W. E., B. & B. Supv., D. & H., Carbondale, Pa., (1945)
Cruikshank, A. W., P. & H., Supvr., D. & H., Green Island, N. Y. (1950)
Cummings, C. P., Asst. Engr., M. K. T., St. Louis, Mo. (1948)
Cummings, E. M., Div. Eng., B. & O., Connellsville, Pa. (1954)
Curie, H. D., Mast. Carp., B. & O., Garrett, Ind. (1942)

D

David, J. J., Asst. Rdm., T. & N. O., Victoria, Tex. (1953)
Davis, H. E., Supvr. B. & B., N. Y. C. Sys., Mattoon, Ill. (1940)
Davis, L. H., Gen. For. B. & B., A. T. & S. F., Amarillo, Tex. (1948)
Day, F. D., Supv. Struc., Penna., New York, N. Y. (1949)
Defendorf, C. E., Asst. Ch. Eng., N. Y. C., Chicago, Ill. (1956)
DeMate, M. A., Str. Engr., St. L. S. F., Springfield, Mo. (1955)
Demmon, H. R., Asst. Gen. B. & B. Insptr., S. P., Albany, Calif. (1948)
Deno, L. J., Div. Engr., C. & N. W., Green Bay, Wis. (1947)
Derryberry, J. T., Gen. B. & B. Insp., W. M., Cumberland, Md. (1955)
DeWitt, E. C., Asst. B. & B. Supvr., S. P., El Paso, Tex. (1955)
Dick, H. M., Supv. of Struc., Penna., Harrisburg, Pa. (1942)
Dick, M. H., V. P. & Editor, Ry. Trk. & Str., Chicago, Ill. (1937)
Dickison, C. S., Supvr. B. & B., C. & O., South Shore, Ky. (1953)
Dilworth, R. W., Drafts., N. Y. C., Detroit, Mich. (1953)
Dixon, C. E., Asst. Supvr. B. & B., M. C., Portland, Me. (1955)
Dixon, N., B. & B. Mast., C. N., Montreal, Que., Can. (1949)
Dobbie, J. E., B. & B. Mast., C. P., Vancouver, B. C., Can. (1953)
Dodson, F., Asst. Supv. B. & B., C. & O., Covington, Ky. (1948)
Dove, R. E., Assoc. Ed., Ry. Trk. & Struc., Chicago, Ill. (1934)
Duchac, J. V., Supv. B. & B., C. & N. W., Antigo, Wis. (1927)
Duresky, F., Jr., Supv. B. & B., C. & N. W., Huron, S. D. (1942)
Dysinger, M. A., Asst. Eng., Southern, Washington, D. C. (1956)

E

Eargle, J. M., Mast. Carp., S. A. L., Atlanta, Ga. (1953)
Eble, A. E., Asst. Tr. Mast., St. L. S. W., Tyler, Texas (1953)
Edlund, O. F., Supv. of W. S. & Equip., B. Ry. Co. of C., Chicago, Ill. (1950)
Eichenlaub, C. M., Res. Engr., S. D. & A. E., San Diego, Calif. (1943)
Eitel, R. A., Asst. Supvr. Str., Penna., Cranford, N. J. (1954)
Ellerbrock, D. T., Mast. Carp., B. & O., Indianapolis, Ind. (1956)
Elliott, C. E., Engr. Trk., W. P., San Francisco, Calif. (1950)
Ellis, P. O., Asst. Ch. Eng.-M., M-K-T., Dallas, Texas (1954)
Elower, L., Trav. Br. Insp., Erie, Owego, N. Y. (1948)
Enderle, R. E., Div. Eng., B. & O., Garrett, Ind. (1955)
Enger, E. M., Supv. B. & B., C. St. P. M. & O., St. Paul, Minn. (1947)
Erickson, H. G., Ch. Engr., L. A. J., Los Angeles, Calif. (1953)
Erickson, O., Asst. B. & B. Supv., S. P., Sacramento, Calif. (1950)
Evans, J. R., Supv. Auto Wk Eqpt., S. P., Tucson, Ariz. (1953)

F

Ferguson, I. D., Asst. Div. Engr., C. & O., Hinton, W. Va. (1953)
Ferry, M. H., Mast. Carp., Erie, Hornell, N. Y. (1952)
Firehammer, L. M., Supv. B. & B., Ill. Term., Springfield, Ill. (1919)
Fisher, D. H., Supvr. Brdg. Maint., C. M. St. P. & P., Chicago, Ill. (1952)
Flayhart, C. I., Insp. M. W., P. R. R., Williamsport, Pa. (1956)
Fogarty, S., Jr., Trk. Supvr. C. of G., Millen, Ga. (1954)
Forseth, C. E., Div. Engr., W. P., Sacramento, Calif. (1950)
Foster, C. B., B. & B. Supvr., Southern, Greensboro, N. C. (1954)
Fox, J., Eng. M. of W., Q. C., Sherbrooke, P. Q., Can. (1956)
Fox, R. L., Proc. Engr.-Str., Sou, Washington, D. C. (1935)
Frederickson, N. H., Supvr. W. S., I. C., Memphis, Tenn. (1956)
Fronabarger, H. C., B. & B. Supv., T. & P., Ft. Worth, Tex. (1949)
Frost, L. M., Supv. B. & B., G. T. W., Battle Creek, Mich. (1938)
Fuhr, W. E., Div. Engr., C. M. St. P. & P., Savanna, Ill. (1948)

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G

Gabrio, C. W., Engr. of Str., Virginian, Norfolk, Va. (1947)
Gannon, J. P., Div. Engr., M. St. P. & S. S. M., Stevens Point, Wis. (1947)
Garcelon, C. E., B. & B. Supt., B. & A., Houlton, Me. (1945)
Garland, E. F., Br. Supv., N. O. P. B., New Orleans, La. (1953)
Geho, R. W., Instrumentman, C. M. St. P. & P., Minneapolis, Minn. (1956)
George, D. W., Div. Engr., W. M., Cumberland, Md. (1956)
Gillespie, W. G., Mast. Carp., B. & O., Grafton, W. Va. (1946)
Gilmore, R. W., Gen. Br. Insp., B. & O., Cincinnati, Ohio (1943)
Gipson, C. G., Gen. Fore. B. & B. - W. S., A. T. & S. F., Winslow, Ariz. (1956)
Gladwin, F. E., B. & B. Supv., N. W. P., San Rafael, Calif. (1950)
Goforth, J. A., Maint. Engr., Clinchfield, Erwin, Tenn. (1954)
Gogl, E. U., B. & B. Supvr., S. P., El Paso, Texas (1955)
Gossard, J. T., Supv. B. & B., W. M., Hagerstown, Md. (1952)
Graham, W. R., Supvr. B. & B., C. & O., Covington, Ky. (1946)
Granger, R. W., Asst. Engr., A. C. & Y., Akron, Ohio (1953)
Grant, J. A., Asst. to Div. Engr., B. & O., Indianapolis, Ind. (1956)
Green, C. C., Mast. Carp., B. & O., Wheeling, W. Va. (1953)
Greene, H. P., Supv. Struct., Penna., Philadelphia, Pa. (1947)
Griffis, T. W., B. & B. Insp., N. Y. C. & St. L., Cayuga, Ind. (1954)
Gunderson, R. R., Eng. Maint. of W., W. M., Baltimore, Md. (1947)
Gustafson, J. M., Br. Engr., M. & St. L., Minneapolis, Minn. (1949)

H

Haase, E. H., B. & B. Supv., S. P., Oakland Pier #7, Calif. (1954)
Hagenmaier, C. E., Asst. B. & B. Supv., S. P., Los Angeles, Calif. (1950)
Haines, P. D., B. & B. Supv., C. & O., Saginaw, Mich. (1943)
Hall, J. H., Asst. Div. Engr., Sou., Atlanta, Ga. (1955)
Hamilton, C. W., Engr. of Design, Wabash, St. Louis, Mo. (1950)
Hamilton, W. A., Jr., Asst. Engr., G. C. & S. F., Galveston, Texas (1955)
Hampton, A. A., Asst. Supv. B. & B., M. P., DeQuincy, La. (1947)
Hancock, J. S., Br. Engr., D. T. & I. R., Dearborn, Mich. (1916)
Hanna, V. C., Ch. Engr., T. R. R. A. of St. L., St. Louis, Mo. (1953)
Hansen, A. E., Ch. Carp., C. M. St. P. & P., Tacoma, Wash. (1954)
Harlow, H. M., Asst. Gen. Supv. B. & B., C. & O., Richmond, Va. (1939)
Harper, W. B., Supv. Trk., I. C., Vicksburg, Miss. (1953)
Harris, A. R., Engr. Br., C. & N. W., Chicago, Ill. (1940)
Hartley, L. M., Mast. Carp., S. A. L., Tampa, Fla. (1949)
Harwood, M. S., Asst. B. & B. Supvr., S. P., San Mateo, Calif. (1948)
Hawkins, C. L., Asst. Supv. Structs., Penna., Pittsburgh, Pa. (1950)
Healy, J. J., Asst. Div. Engr., B. & M., Boston, Mass. (1947)
Heck, J. E., Supt. B. & B., C. & O., Ashland, Ky. (1938)
Hecker, R. L., B. & B. & W. S. Supvr., C. & O., Plymouth, Mich. (1947)
Hedley, W. J., Asst. Ch. Engr., Wabash, St. Louis, Mo. (1950)
Hefte, A., Asst. B. & B. Supv., N. W. P., San Rafael, Calif. (1952)
Hellickson, D. E., Mast. Carp., G. N., Whitefish, Mont. (1954)
Hellweg, R. D., Asst. Div. Engr., G. M. & O., Bloomington, Ill. (1947)
Hemstad, B., Mast. Carp., G. N., Willmar, Minn. (1937)
Hendrix, W. P., Asst. to Ch. Engr., Penna., Pittsburgh, Pa. (1954)
Hickok, B. M., Supv. B. & B., N. Y. C., Cleveland, Ohio (1951)
Hillman, A. B., Ch. Engr., B. Ry. Co. of C., & C. & W. I., Chicago, Ill. (1942)
Hillman, W. C., Mast. Carp., Clinchfield, Erwin, Tenn. (1953)
Hiner, J. T., B. & B. Supv., Southern, Greenville, S. C. (1950)
Hodgson, A. W., Ch. Carp., C. M. St. P. & P., Butte, Mont. (1955)
Hofstetter, P. W., Asst. B. & B. Supv., M. P., San Antonio, Tex. (1946)
Holmes, E. J., Mast. Carp., Erie, Huntington, Ind. (1952)
Hopton, J. P., Engr. of Maint., C. U. T., Cincinnati, Ohio (1955)
Hornig, F. F., Div. Engr., C. M. St. P. & P., Sioux City, Ia. (1947)
Hotard, A. E., Res. Engr., L. & N., Bay St. Louis, Miss. (1953)
Howard, J. G., Project Supvr., W. P., Sacramento, Calif. (1953)
Hoyt, A. C., Engr. B. & B., E. J. & E., Joliet, Ill. (1947)
Hubbard, M. J., Asst. Ch. Eng., C. & O., Richmond, Va. (1948)
Huckaby, V. T., Asst. Div. Eng., M-K-T., Hillsboro, Texas (1947)
Huffman, W. H., Asst. Eng. M., C. & N. W., Chicago, Ill. (1941)
Humphreys, R. W., Prin. Asst. Eng., N. P., St. Paul, Minn. (1947)
Humphries, A. G., Water Serv. Engr., S. P., San Francisco, Calif. (1955)
Hutcheson, F. W., Supv. B. & B., C. & O., Newport News, Va. (1938)

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Hutchings, V. W., B. & B. Supvr., S. P., Bakersfield, Calif. (1941)
Hutchinson, D. G., B. & B. Insp., W. P., Sacramento, Calif. (1950)
Hutchison, W. D., Asst. Div. Eng., C. N., Ottawa, Ont., Can. (1956)
Hutto, J. E., Res. Engr., S. A. L., Savannah, Ga. (1951)

I

Inabinet, J. V., Gen. Br. Insp., S. A. L., Jacksonville, Fla. (1948)
Ingram, J. L., Struc. Drafts., T. R. R. A. of St. L., St. Louis, Mo. (1954)

J

Jackman, H. E., Mast. Carp., B. & O., Chillicothe, Ohio (1944)
Jackson, S. M., Prin. Asst. Engr., M. P., Houston, Tex. (1951)
Jackson, T. E., Gen. B. & B. Supv., S. P., San Francisco, Calif. (1942)
Jarratt, M., W. & F. Supv., S. P., Tucson, Ariz. (1950)
Jenkins, H. W., Asst. Ch. Engr., N. Y., N. H. & H., New Haven, Conn. (1940)
Jenkins, R. W., Assoc. Str. Engr., St. L. S. F., Springfield, Mo. (1955)
Johns, D. H., Asst. Supv. of Struc., Penna., Buffalo, N. Y. (1953)
Johnson, A. C., Asst. Ch. Engr., E. J. & E., Joliet, Ill. (1944)
Johnson, B. O., Off. Engr., C. M. St. P. & P., Chicago, Ill. (1931)
Johnson, D. H., Supv. B. & B., C. St. P. M. & O., Altoona, Wis. (1940)
Johnson, E. A., Engr. of Br., I. C., Chicago, Ill. (1953)
Johnson, E. M., Asst. Div. Rdm., D. M. & I. R., Virginia, Minn. (1956)
Johnson, G. C., B. & B. Supvr., C. & N. W., Green Bay, Wis. (1955)
Johnston, G. H., Gen. For. B. & B., A. T. & S. F., Marceline, Mo. (1950)
Jones, A. C., B. & B. Supv., Southern, Birmingham, Ala. (1938)
Jones, E. B., Supvr. B. & B., C. & O., Clifton Forge, Va. (1945)
Jones, F. Gen. For. B. & B., & W. S., St. L. - S. F., Chaffee, Mo. (1952)
Jorlett, J. A., Engr. Str., P. R. R., Baltimore, Md. (1946)

K

Kaullen, W. C., B. & B. Supv., M. P., Kansas City, Mo. (1953)
Kelly, G. E., W. & F. Supvr., S. P., Bakersfield, Calif. (1953)
Kelly, J. R., B. & B. Supv., Southern, Lexington, Ky. (1952)
Kendall, J. T., Asst. Supvr. Str., P. R. R., Cleveland, Ohio (1949)
Kenyon, J. R., Gen. B. & B. Supvr., N. Y., N. H. & H., New Haven, Conn. (1955)
Kidd, J. W., Asst. Ch. Engr., Southern, Charlotte, N. C. (1954)
Kizak, S. F., B. & B. Insp., P. R. R., Chicago, Ill. (1956)
Klouda, R. G., Draftsman, C. M. St. P. & P., Chicago, Ill. (1956)
Knapp, P., Mast. Carp., Erie, Jersey City, N. J. (1951)
Koehler, P. L., Supt. Simp. Transp. Dept., C. & O., Huntington, W. Va. (1938)
Krefting, A. S., Asst. Ch. Engr., M. St. P. & S. S. M., Minneapolis, Minn. (1935)
Kvenberg, S. E., Supvr. Bldg. Maint., C. M. St. P. & P., Chicago, Ill. (1932)

L

LaBat, J. J., B. & B. Supvr., M. P., Wichita, Kans. (1955)
Lamport, L. R., Ch. Engr. Mtce., C. & N. W., Chicago, Ill. (1935)
Lane, H. W., Rdm., E. J. & E., Joliet, Ill. (1952)
Larson, L. M., Asst. Mast. Carp., G. N., Superior, Wis. (1954)
Laurick, M. J., Asst. Supvr. Str., P. R. R., Ft. Wayne. Ind. (1952)
Layman, D. C., Gen. B. & B. Fore., I. C., Memphis, Tenn. (1952)
Layman, W. E., Gen. Fore. B. & B., I. C., Carbondale, Ill. (1954)
Leach, A. L., Asst. Eng. of Brdg., I. C., Chicago, Ill. (1955)
Leak, V. L., Gen. For. B. & B. & W. S., St. L. - S. F., Tulsa, Okla. (1948)
LeClaire, N. C., Supt. B. & B., T. R. R. A., of St. L., St. Louis, Mo. (1952)
Lehman, H. G., B. & B. Supv., S. P., Tucson, Ariz. (1950)
Leinweber, F. J., B. & B. Mast., C. N., St. Thomas, Ont., Canada (1947)
Lieser, H. J., Supvr. B. & B., C. & W. I., Chicago, Ill. (1948)
Lingle, T. N., Supvr., B. &. B., I. C., Carbondale, Ill. (1951)
Linn, G. A., Div. Engr., C. & N. W., Chadron, Neb. (1940)
Little, H. C., Supv. of W. S., I. C., Vicksburg, Miss. (1948)
Lokotzke, G. P., Supv. B. & B., E. J. & E., Gary, Ind. (1947)
Lorber, R. J., Supv. B. & B., P. & P. U., Peoria, Ill. (1948)
Lowry, J. M., Ch. Engr., St. L. S. W., Tyler, Tex. (1950)
Lucas, H. F., Asst. Engr., C. M. St. P. & P., Chicago, Ill. (1952)
Luce, W. L., Mast. Carp., Erie, Youngstown, Ohio (1952)
Luck, R. P., Draftsman, C. & N. W., Chicago, Ill. (1920)
Lund, C. V., Asst. to Ch. Eng., C. M. St. P. & P., Chicago, Ill. (1947)
Lyon, L. E., Div. Engr., S. P., Tucson, Ariz. 1947)

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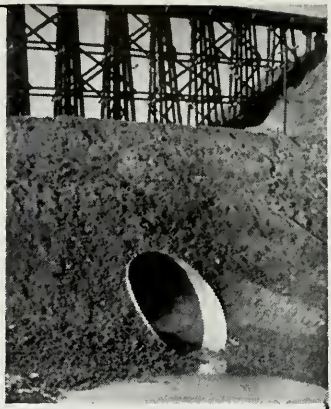

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*McCallum, S. L., Arch. Designer, M. C., Detroit, Mich. (1952)
McCauley, M. L., Dist. Engr. Str., N. Y. C., Cleveland, Ohio (1950)
McCollum, P. K., Bldg. Insp., I. C., Memphis, Minn. (1955)
McDermott, A. A., B. & B. Supv., S. P., Dunsmuir, Calif. (1945)
McDonald, J. W., Gen. For. B. & B. & W. S., St. L. - S. F., Springfield, Mo. (1947)
McElreath, C. S., B. & B. Supvr., Sou., Atlanta, Ga. (1951)
McFadden, W. E., Ch. Carp., C. M. St. P. & P., Milwaukee, Wis. (1955)
McGee, M. A., Div. Engr., L. & N., Ravenna, Ky. (1954)
McGlothlin, J. W., Div. Engr., C. M. St. P. & P., Aberdeen, S. D. (1955)
McGrew, B. H., Supv. B. & B., St. L. S. W., Tyler, Tex. (1951)
McGrew, F. O., Ch. Carp., C. M. St. P. & P., La Crosse, Wis. (1948)
McIver, J., B. & B. Supvr., N. S., Edenton, N. C. (1956)
McKenney, C. E., System Scale Insp., N. Y. C. & St. L., Ft. Wayne, Ind. (1956)
McKibben, D. H., Supvr. Str., P. R. R., Columbus, Ohio (1951)
McLeod, C. A., Asst. Supt., St. L. - S. F., Newburg, Mo. (1953)
McMillen, J. W., Off. Engr., T. R. R. A. of St. L., St. Louis, Mo. (1954)
McNally, P. F., B. & B. Supv., S. P., Ogden, Utah (1948)

M

Madson, H. C. (Ret.), Designer, C. & N. W., Elmhurst, Ill. (1940)
Manning, D. A., Supv. B. & B., C. & N. W., Chicago, Ill. (1939)
Manter, E. E., Supvr. B. & B., M. C., Portland, Me. (1955)
Martens, W. F., Gen. For. B. & B., A. T. & S. F., San Bernardino, Calif. (1924)
Martin, J. D., Ch. Carp., C. M. St. P. & P., Sioux City, Iowa (1955)
Martin, J. G., Jr. Engr., St. L. - S. F., Springfield, Mo. (1954)
Martin, J. W., Asst. Mast. Carp., S. A. L., Tampa, Fla. (1953)
Martin, S. L. Asst. B. & B. Supv., T. & N. O., LaFayette, La. (1951)
Mason, E. L., B. & B. Supv., M. P., Kingsville, Tex. (1946)
Mason, S. K., Ch. Engr., T. M., Laredo, Tex. (1950)
Mateer, W. G., Mgr. of Pur. & Stores, E. J. & E., Chicago, Ill. (1944)
Mathis, R. C., Br. Insp., I. C., Memphis, Tenn. (1947)
Matthews, H. A., Gen. For. B. & B. & W. S., St. L. - S. F., Amory, Miss. (1949)
Matthews, W. L., Sr. Asst. B. & B. Supv., S. P., Tucson, Ariz. (1953)
May, L. E., B. & B. For., A. T. & S. F., Fresno, Calif. (1948)
Mayfield, L., Res. Eng. M. P., St. Louis, Mo. (1944)
Mays, J. W. N., Eng. Str., P. R. R., Chicago, Ill. (1947)
Meeks, W. R., B. & B. Supv., M. P., Falls City, Neb. (1942)
Meredith, W. E., Supvr. Str., P. R. R., Canton, Ohio (1950)
Merrill, B. W., Supv. B. & B., N. Y. C. & St. L., Conneaut, Ohio (1936)
Meserve, E. S., Supvr. B. & B., B. & M., Dover, N. H. (1949)
Messman, D. V., Engr. of Bdgs., Southern, Knoxville, Tenn. (1955)
Mettlach, P. A., B. & B. Fore., G. B. & W., Arcadia, Wis. (1956)
Meyers, B. R., Ch. Engr., C. & N. W., Chicago, Ill. (1930)
Midkiff, R. B., Ch. Engr., M. W. & S., Sou., Knoxville, Tenn. (1953)
Miesenhelder, P. D., Concrete Engr. Research Staff - A.A.R., Chicago, Ill. (1952)
Miller, R. H., Prin. Asst. Engr., B. & A., Houlton, Me. (1953)
Milne, A. P., Supv. B. & B., N. Y. C. & St. L., Frankfort, Ind. (1953)
Mitchell, D. N., Asst. Supv. B. & B., C. & O., Newport News, Va. (1948)
Moline, R. F., Asst. Brdg. Eng., D. T. & I., Dearborn, Mich. (1956)
Montague, C. F., Supt. M. W. Equip., P. R. R., Philadelphia, Pa. (1953)
Moore, A. J., Br. Insp., M. P., Eunice, La. (1950)
Moore, H. R., Ch. Eng. M. W. & S., Sou., Charlotte, N. C. (1956)
Moore, H. S., B. & B. Mast., C. P., Revelstoke, B. C. Can. (1954)
Moore, I. A., Ch. Engr., C. & E. I., Danville, Ill. (1937)
Moore, J. D., Engr. Str., P. R. R., Indianapolis, Ind. (1953)
Moreland, H. B., B. & B. Supv., Southern, Wilton, Ala. (1951)
Morgan, C. E., Asst. B. & B. Supvr., T. & N. O., San Antonio, Texas (1954)
Morgan, L. R., Eng., N. Y. C., Detroit, Mich. (1937)
Moris, R. F., B. & B. Supvr., N. Y., C. & St. L., Ft. Wayne, Ind. (1955)
Morrison, R. H., Ch. Engr., B. & A., Houlton, Me. (1941)
Morrissey, J. K., Supvr. M. of W. Reports, C. & O., Richmond, Va. (1955)
Moser, C. A., B. & B. Supvr., S. N. & T. S., Sacramento, Calif. (1951)
Moser, C. L., B. & B. Supvr., Southern, Asheville, N. C. (1955)
Mottier, C. H., Vice Pres. & Ch. Engr., I. C., Chicago, Ill. (1942)

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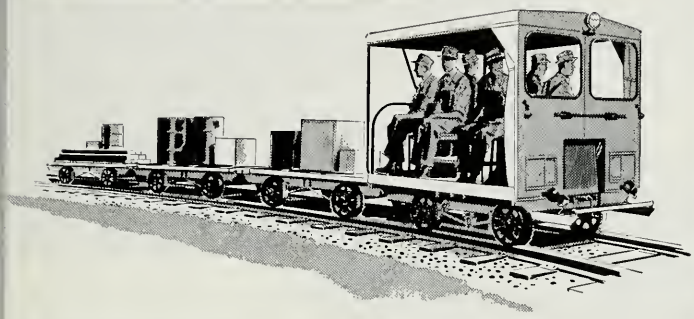

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Murray, D. J., Engr. Dftsman, C. & W. I.-B. Ry. of C., Chicago, Ill. (1954)
Myers, R. L., Supv. W. S., I. C., Clarksdale, Miss. (1950)

N

Neal, G. W., Supt., Chattahoochee Valley, West Point, Ga. (1948)
Neely, Z. D., Mast. Carp., B. & O., Washington, Ind. (1955)
Nelson, M., Brdg. Insp., N. Y. C., Mattoon, Ill. (1956)
Nicely, O. P., Asst. Supv. B. & B., C. & O., Clifton Forge, Va. (1950)
Nichols, J. C., Br. Engr., L. & N., Louisville, Ky. (1954)
Nilan, W. J., Asst. Gen. B. & B. Supvr., N. Y., N. H. & H., New Haven, Conn. (1956)
Norris, H. Asst. Supv. B. & B., F. E. C., Miami, Fla. (1948)
Norton, R. L., Mast. Carp., S. A. L., Savannah, Ga. (1951)

O

O'Brien, J. B., Asst. Supvr. B. & B., C. & O., Richmond, Va. (1954)
Odgers, F. T., Asst. B. & B. Supvr., S. P., Portland, Oreg. (1955)
Oest, W. C., Prin. Asst. Engr., Ft. W. & D., Ft. Worth, Tex. (1947)
Ogle, H., Bridge Insp., C. & E. I., Salem, Ill. (1956)
Olson, O. D., B. & B. Supv., C. & N. W., Chicago, Ill. (1953)
Olson, V. E., B. & B. Supv., M. St. P. & S. S. M., Stevens Point, Wis. (1948)
Ornburn, B. J., Asst. Ch. Engr. Struct., C. M. St. P. & P., Chicago, Ill. (1948)
Ostrom, W. D., Ch. Carp., C. M. St. P. & P., Chicago, Ill. (1954)
Ovardits, K., Asst. Engr., N. Y. C., Chicago, Ill. (1953)
Owens, B. H., Supvr. B. & B., I. C., Vicksburg, Miss. (1956)

P

Packard, B. G., Office Engr., C. & N. W., Chicago, Ill. (1954)
Pahl, W. H., Jr., Supvr. Str., P. R. R., Cleveland, Ohio (1950)
Parrish, E. L., Div. Engr., I. C., Vicksburg, Miss. (1947)
Patrick, F. V., B. & B. Supv., Southern, Knoxville, Tenn. (1954)
Patterson, C. A., B. & B. Supvr., T. P. & W., Washington, Ill. (1955)
Patterson, R. H., B. & B. Supvr., St. L. S. W., Pine Bluff, Ark. (1955)
Pearson, A. H., Mast. Carp., C. B. & Q., St. Joseph, Mo. (1952)
Peden, J. S., W. S. Supv., T. & P., Big Spring, Tex. (1953)
Pederson, W. E., B. & B. Supv., M. St. P. & S. S. M., Superior, Wis. (1950)
Peek, J. M., B. & B. Supv., Southern, Greenville, S. C. (1951)
Penhallegon, J. R., Asst. Supv. B. & B., C. & N. W., Chicago, Ill. (1940)
Perrier, J. L., Div. Engr., C. & N. W., Chicago, Ill. (1953)
Perrine, D. E., Asst. Ch. Engr., C. & W. I., Belt Ry. Co. of Chgo., Chicago, Ill. (1953)
Perry, C., Asst. Supv. B. & B., C. & O., Ashland, Ky. (1950)
Peterson, H. R., Ch. Engr., N. P., St. Paul, Minn. (1953)
Peterson, J. C., Sr. Asst. B. & B. Supv., S. P., Sacramento, Calif. (1950)
Peterson, N. E., Ch. Engr., C. & I. M., Springfield, Ill. (1938)
Petteys, W. F., Div. Engr., Erie, Hornell, N. Y. (1948)
Pfeiffer, A., Asst. B. & B. Supvr., S. P., Stockton, Calif. (1939)
Phelps, C. E., B. & B. Supvr., A. & W. P. - W. Ry. of A., Camak, Ga. (1949)
Phillips, B. C., Mast. Carp., C. B. & Q., Alliance, Neb. (1947)
Phillips, E. L., Mast. Carp., C. B. & Q., Casper, Wyo. (1953)
Piepmeier, A. L., Br. Engr., C. G. W., Oelwein, Ia. (1953)
Pocino, E. A., Gen. Fore., P. R. R., New York, N. Y. (1955)
Podas, N. F., Ch. Engr., St. P. U. D. Co. & M. T. Ry. Co., St. Paul, Minn. (1937)
Pound, E. R., Mast. Carp., B. & O., Newark, Ohio (1952)
Preston, C. W., Engr. Prot. Coatings, B. & O., Baltimore, Md. (1950)
Price, A. C., B. & B. Master, C. P., London, Ont., Can. (1953)
Pritchard, B. L., Gen. Fore. B. & B. - W. S., A. T. & S. F., Clovis, N. Mex. (1956)
Prude, G. F., Supv. B. & B., T. & N. O., Houston, Tex. (1951)
Pryor, W. H. (Ret.), Gen. Fore. B. & B. & W. S., St. L. - S. F., Memphis, Tenn. (1946)
Pyle, T. V., Engr. of Design, E. J. & E., Joliet, Ill. (1954)

R

Raessler, V. D., Supv. B. & B., I. C., Memphis, Tenn. (1951)
Rainey, W. H., B. & B. Supvr., T. & N. O., San Antonio, Texas (1956)
Rapant, F., Asst. Supvr. Str., P. R. R., New York, N. Y. (1955)
Rapier, L. F., Supv. B. & B., G. M. & O., Bloomington, Ill. (1946)
Rasmussen, L. B., Supvr. Str., P. R. R., Williamsport, Pa. (1954)
Raver, H. E., Engr. B. & B., L. I., Jamaica, N. Y. (1952)
Reed, T. C., Supv. B. & B., L. & N., Ravenna, Ky. (1954)
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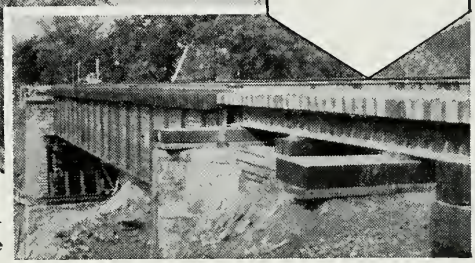

When Hurricane Diane's disastrous floods swept down the Delaware Gorge in August 1955, among the many washed-out bridges was the 100-year-old stone arch on the mainline of the Erie RR over Panther Creek at Shohola, Pa. *The wreckage was so complete that restoration seemed months away.*

An inspection of existing foundations revealed that they were adequate to support a modern steel girder bridge. Verbal orders and specifications for replacement plans were received at the Ambridge works of American Bridge on August 31st. The fabricating shops were ready to begin work when the blueprints arrived two days later, although some of the steel for the 50-ton girders was yet to emerge from the open hearths and rolling mills.

Using every means at its command to speed fabrication, American Bridge was able to ship the two 109-foot girders in a record 8 days. The job was completed at the site at 8 A.M., September 10th, thus enabling the Erie to resume traffic over its mainline in just 9 days after American Bridge first received specifications for the big girders.

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Riffle, L. R., Ch. Carp., C. M. St. P. & P., Tama, Ia. (1956)
Robbins, C. W., Div. Eng., M. K. T., Smithville, Texas (1954)
Roberts, J. T., B. & B. Supvr., Sou., Somerset, Ky. (1956)
Robertson, J. H., Asst. Engr., M. P., Houston, Tex. (1953)
Robinson, G. E., Engr. Struct., N. Y. C. Sys., Chicago, Ill. (1948)
Robinson, N. R., B. & B. Supv., S. P., Sacramento, Calif. (1934)
Rode, L. A., Gen. Br. Insp., Erie, Newark, N. J. (1948)
Routenberg, H. W. (Retired), Mast. Carp., B. & O., Baltimore, Md. (1946)
Rowland, J. W., Supvr. Str., L. I., Jamaica, N. Y. (1956)
Rumke, R. W., Asst. Eng., Sou., Washington, D. C. (1956)
Russell, C. E., Supv. W. S., I. C., Chicago, Ill. (1953)

S

Safley, J. R., B. & B. Supv., S. P., San Mateo, Calif. (1945)
Salmon, J. M., Jr., Ch. Engr., Clinchfield, Erwin, Tenn. (1938)
*Sarris, P. T., Asst. Supvr., Sou., Jacksonville, Fla. (1955)
Sathre, C. O., B. & B. Supv., C. & N. W., Madison, Wis. (1950)
Saunders, H. M., Supv. B. & B., C. & O., Richmond, Va. (1954)
Saunders, T. D., Ch. Engr., O. N., North Bay, Ont., Can. (1930)
Saurer, D. E., Asst. Supv. Struct., Penna., Logansport, Ind. (1951)
Sawyer, J. H., Jr., Ch. Engr., C. G. W., Oelwein, Ia. (1951)
Schlaf, E. R., Asst. Supt. W. S., I. C., Chicago, Ill. (1947)
Schmidl, R. M., Asso. Editor, Railway Age-Ry. Trk. & Str., Chicago, Ill. (1956)
Schneider, J. C., B. & B. Supv., T. & N. O., Victoria, Tex. (1950)
Schroeder, A. W., Pres., M. & St. L., Minneapolis, Minn. (1949)
Scites, P. E., Asst. Supvr. B. & B., C. & O., Huntington, W. Va. (1950)
Scroggin, D. R., Jr., Engr., C. S. S. & S. B., Michigan City, Mich. (1953)
Seals, R. K., Div. Engr., Southern, Greensboro, N. C. (1951)
Seley, L. L., Mast. Carp., C. B. & Q., Hannibal, Mo. (1953)
Sharkey, J. J. (Ret.), Gen. Fore. B. & B., P. R. R., Short Hills, N. J. (1951)
Shepley, S. H., Ch. Engr., E. J. & E., Joliet, Ill. (1945)
Short, W. L., Br. Insp., M. P., St. Louis, Mo. (1951)
Shryer, L. S., Gen. Fore. B. & B., A. T. & S. F., Winslow, Ariz. (1954)
Siegfried, F. A., For. Carp., Reading, Reading, Pa. (1947)
Simmons, E. R., Asst. B. & B. Supvr., St. L. S. W., Pine Bluff, Ark. (1955)
Simpter, R. U., Asst. Supvr. B. & B., B. & M., Boston, Mass. (1955)
Sinclair, C. H., Asst. Supv. B. & B., C. & N. W., Milwaukee, Wis. (1954)
Skinner, H. E., Supv. Scales & Wk. Equip., E. J. & E., Joliet, Ill. (1944)
Slagle, G. P., Ch. Carp., C. M. St. P. & P., Milwaukee, Wis. (1948)
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Smith, C. A., Supv. B. & B., C. R. & I. and I. H. B., Hammond, Ind. (1946)
Smith, E. L., B. & B. Supv., Southern, Hattiesburg, Miss. (1952)
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Stevens, C. M., B. & B. Supv., S. P., Portland, Ore. (1950)
Stinebaugh, J. H., Supv. W. S., I. C., Carbondale, Ill. (1951)
Strawhun, G. M., Div. Engr., M. P., Poplar Bluff, Mo. (1955)
Strouss, J. A., Asst. Supv. B. & B., S. P., Sacramento, Calif. (1934)
Sumner, J., W. S. For., St. L. - S. F., Springfield, Mo. (1948)
Swanson, M., Insp. B. & B., D. T. & I., Dearborn, Mich. (1953)
Sweet, W. A., Gen. For. B. & B., A. T. & S. F., Newton, Kan. (1928)
Switzer, G., Gen. Supv. Str. & Wk. Equip., W. P., Oakland, Calif. (1949)
Switzer, R. E., Gen. For. B. & B. & W. S., G. C. & St. F., Galveston, Tex. (1952)

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Taggart, C. R., Supv. B. & B., N. Y. C., Indianapolis, Ind. (1935)
Talman, J. S., Gen. Supvr. B. & B., C. & O., Richmond, Va. (1956)
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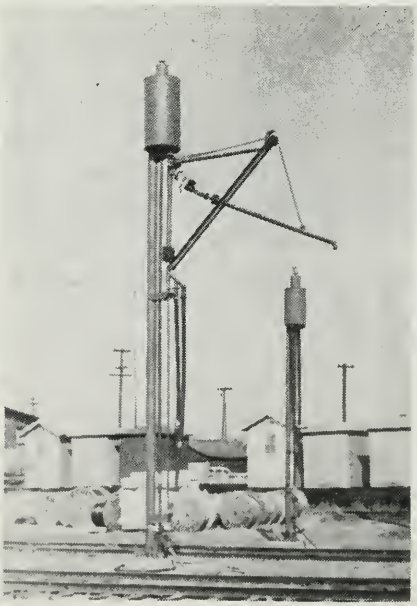

Taylor, F. H., Eng. M. of W., F. E. C., St. Augustine, Fla. (1951)
Taylor, W. L., B. & B. Supv., Southern, Jasper, Ala. (1950)
Templin, R. S., For. Carp., Reading, St. Clair, Pa. (1947)
Termunde, W. L., Asst. Rdm., Belt Ry. of C., Chicago, Ill. (1956)
Tetreault, L. J., B. & B. Fore., N. Y., N. H. & H., Providence, R. I. (1936)
Thelander, P. V., Asst. Ch. Engr., C. & N. W., Chicago, Ill. (1939)
Thomason, C. G., Bldg., Insp., M. P., Harlingen, Texas (1956)
Tieman, L. G., Act. Ch. Drafts, C. & N. W., Chicago, Ill. (1956)
Tilley, E. L., Bridge Insp. I. C., Memphis, Tenn. (1956)
Todd, D. C., Engr. Str., P. R. R., Pittsburgh, Pa. (1942)
Toh, J. S., Drft., M.P., St. Louis, Mo. (1956)
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Tunison, H. C., Ch. Eng., L. & N. E., Bethlehem, Pa. (1946)
Tyckoson, E. G., Asst. Ch. Carp., C. M. St. P. & P., Chicago, Ill. (1954)
Tyckoson, E. G., Jr., Drafts., C. M. St. P. & P., Chicago, Ill. (1955)

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Van Ness, R. A., Br. Engr. Sys., A. T. & S. F., Chicago, Ill. (1949)
Varker, J. L., Spec. Eng., D. & H., Albany, N. Y. (1936)
Von Behren, G., Asst. Supvr. Str., P. R. R., Baltimore, Md. (1956)
von Sprecken, R. E., Trk. Supv., Southern, Winston Salem, N. C. (1951)
von Sprecken, T. M., Asst. to Ch. Engr., Southern, Washington, D. C. (1938)

W

Walker, G. P., Supv. B. & B., M. P., Monroe, La. (1929)
Wall, E. G., Div. Engr., G. M. & O., Bloomington, Ill. (1942)
Wall, R., Supv. B. & B., Southern, Selma, Ala. (1948)
Wallace, C. E., Gen. For. B. & B. & W. S., St. L. - S. F., Ft. Smith, Ark. (1948)
Wang, A. B., Supv. B. & B., C. I. & L., Lafayette, Ind. (1950)
Ward, W. G., Asst. Supv. B. & B., C. & N. W., West Chicago, Ill. (1952)
Ware, W., Div. Eng., C. R. I. & P., Little Rock, Ark. (1956)
Warfield, H. Jr. (Ret.), Insp. M. of W., P. R. R., New Brunswick, N. J. (1952)
Warfield, W. B., Supvr. Str., P. R. R., Camden, N. J. (1951)
Warren, J. A., B. & B. Insp., M. P., San Antonio, Texas (1955)
Warrenfells, J. F., Jr., Prin. Asst. Div. Eng., S. A. L., Raleigh, N. C. (1946)
Weatherly, H. E., Div. Eng., T. & N. O., El Paso, Texas (1950)
Weaver, W. R., Ch. Mech. Off. and Ch. Eng., P. & S., Brookville, Pa. (1951)
Webber, G. R., Ch. Carp., C. M. St. P. & P., Spokane, Wash. (1948)
Welch, J. W., Supv. B. & B., F. E. C., St. Augustine, Fla. (1943)
White, J. A., Jr., Asst. Eng. N. S., Norfolk, Va. (1956)
White, L. H., Supvr. B. & B., I. C., New Orleans, La. (1946)
White, S., Gen. B. & B. Supv., S. P., San Francisco, Calif. (1942)
Wiitala, A., Gen. For. B. & B., L. S. & I., Marquette, Mich. (1941)
Wiklund, W. W., Asst. Mast. Carp., G. N., Everett, Wash. (1955)
Williams, C., Asst. Supv. B. & B., C. & O., Ashland, Ky. (1950)
Williams, D. R., Brdg. Insp., C. & E. I., Danville, Ill. (1956)
Williams, L. L., B. & B. Supv., L. & N., Birmingham, Ala. (1953)
Williams, N. H., B. & B. Mast., D. & H., Oneonta, N. Y. (1947)
Williams, W. T., B. & B. Supvr., T. & N. O., Ennis, Texas (1956)
Wilson, H. M., Asst. Supv. Struc., Penna., Columbus, Ohio (1953)
Wilson, R. P., Supv. B. & B., C. & O., Hinton, W. Va. (1948)
Wintoniak, S. G., Supv. of Struc., Penna., Altoona, Pa. (1953)
Wistrich, H. A., Asst. Ch. Engr., L. V., Bethlehem, Pa. (1938)
Witherspoon, J. P., Mast. Carp., S. A. L., Savannah, Ga. (1948)
Wood, R. E., Supvr. B. & B., G. N., Great Falls, Mont. (1954)
Woodward, J. D., Supvr. Meth. & Cost Cont.-Eng. P.R.R., Cleveland, Ohio (1952)
Woolford, F. R., Ch. Engr., W. P., San Francisco, Calif. (1950)
Worden, R. K., Gen. Fore. B. & B. & W. S., G. C. & S. F., Ft. Worth, Tex. (1954)
Wray, H. O., Sec. & Ch. Engr., T. C. Term., Texas City, Tex. (1939)
Wrights, H., Supv. B. & B., M. P., Little Rock, Ark. (1929)

Y

Yaw, D. M., Mast. Carp., Erie, Buffalo, N. Y. (1951)
Yewell, J. E., Ch. Engr., B. & L. E., Greenville, Pa. (1941)

Z

Zapfe, E. J., Asst. Ch. Engr. & Supt. B. & B., G. B. & W., Green Bay, Wis. (1952)
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B

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Benjamin, H. I., (Ret.), Vice Chair. Sys. Com. on Ins., S. P., San Francisco, Calif. 1922
Bost, M. A., (Ret.), Asst. Engr., C. M. St. P. & P., Mason City, Iowa 1935

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Engman, V. E., (Ret.), Ch. Carp., C. M. St. P. & P., 3429 - 17th Ave., So.,
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Garis, L. D., (Ret.), Gen. Br. Insp., C. & N. W., 12 N. Home Ave., Park Ridge, Ill. . . 1930
Gentis, I., (Ret.), Fore. B. & B., S. P., 2003 West St., Oakland, Calif. 1912
Geyer, C. J., (Ret.), Vice Pres., C. & O., Huntington, W. Va. 1928
Gillette, J. E., (Ret.), Carp. Fore., C. M. St. P. & P., c/o Carp. Fore., C. M. St. P. & P.
Mazomanie, Wis. 1923
Gillis, A. D., (Ret.), B. & B. Supvr., N. Y. N. H. & H., c/o B. & B. Supvr.,
N. Y., N. H. & H., Providence, R. I. 1923
Glander, A. M., (Ret.), Ch. Carp., C. M. St. P. & P., 2008 Lake Shore Dr.,
Austin, Minn. 1936
Gunderson, E., (Ret.), Supt. B. & B., C. St. P. M. & O., Altoona, Wis. 1927
Guppy, B. W., (Ret.), Engr. Strucs., B. & M., 52 Stratford Rd., Melrose, Mass. 1914

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Hand, G. W., (Ret.), Asst. to Pres., C. & N. W., 412 Courtland Ave., Park Ridge, Ill. . . 1909
Harman, W. C., (Ret.), Supv. B. & B., S. P., 656 Cedar St., San Carlos, Calif. 1911
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Lampson, W., (Ret.), Supvr. B. & B., M. C., 170 Caleb St., Portland, Me.....1930
Landstrom, C. A., (Ret.), Supvr. B. & B., C. B. & Q., 1311 S. 3rd St., Burlington, Ia...1928
Larsen, H. C., (Ret.), Str. Iron Fore., C. St. P. M. & O., 1084 Sims Ave., St. Paul 6, Minn.....1928
Lincoln, S., (Ret.), Gen. Fore. B. & B., G. C. & S. F., 1903 Harrison Ave., Beaumont, Tex.....1927
Lord, H. T., (Ret.), B. & B. Mast., C. P., 415 Third St., So., Kenora, Ont., Canada...1940

Mc

McKay, A. G., (Ret.), Supvr. B. & B., N. Y., N. H. & H., 11 Pine Island Road, Jupiter Pt. Groton, Conn.....1915
McMahon, T. D., (Ret.), Arch., G. N., 223 Lake Avenue, White Bear Lake 10, Minn...1918

M

Manley, B. F., (Ret.), Supvr. B. & B., P. E., Los Angeles, Calif.....1916
Masters, F. H., (Ret.), Spec. Engr., E. J. & E., 907 Glenwood Ave., Joliet, Ill.....1920
Mead, E. L., (Ret.), Div. Engr., C. & N. W., 536 N. E. 69th St., Miami, Fla.....1923
Mellgren, J., (Ret.), Fore. W. S., C. & N. W., 523 N. Cadwell Ave., Eagle Grove, Ia...1913
Merwin, P. B., (Ret.), Asst. Engr., C. & N. W., Rte. 2, Box 565, Washougal, Wash....1929
Miller, C. E., (Ret.), Asst. Engr. M. of W., C. & N. W., 251 Woodland Rd., Highland Pk., Ill.....1916

N

Nies, A. B. (Ret.), Arch., N.Y.C.System, 408 Third St., Jackson, Mich.....1915

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O'Brien, W. J., (Ret.), Dist. Carp., C.M.St.P. & P., Juneau County, Necedah, Wis.....1919

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Parker, W. V., (Ret.), Gen.Fore.B & B., St.L.S.W., 683 Berclair Rd., Memphis 12, Tenn. 1911
Patenaude, E., (Ret.), B. & B. Mast., C. P., 133 John St., Sturgeon Falls, Ont., Can. 1930
Phillips, W. J., (Ret.), Asst. Gen.Br.Insptr.,S.P., 318 Arlington Ave., Berkeley, Calif. 1925
Piccone, C., (Ret.), Br. Engr., Nat.Rys. of Mex., Monte Everest 210, Lomas de Chapultepec, Mexico City, Mex. 1923
Pinard, T. W., (Ret.), Ch. Engr., L. I., 9 Broadview Ave., Box 692, Bellport, L. I., N. Y. 1920

R

Reece, A. N., (Ret.), Asst. to Pres., K. C. S., 2808 Verde Vista Dr., Santa Barbara, Calif. 1922
Richards, C. A. J., (Ret.), Asst. Supvr. Str., P. R. R., 1428 Byron St., S.E., Grand Rapids, Mich. 1924
Rights, H. T., (Ret.), Asst. Br. Engr., L. V., 1015 Raymond Ave., Bethlehem, Pa. 1927
Rintoul, D. T., (Ret.), Gen. Br. Inspr., S. P., 2571 Glen Green, Hollywood 28, Calif. 1910
Roof, W. R., (Ret.), Br. Engr., C. G. W., 7728 So. Yates Ave., Chicago 49, Ill. 1927
Rowland, O. F., (Ret.), Asst. Engr., D. & H., c/o Berkshire Industrial Farm, Canaan, N. Y. 1923

S

Scheetz, F. B., (Ret.), Asst. Engr., M. P., 3930 Connecticut Ave. N.W., Washington, D. C. 1905
Shobert, F., (Ret.), Sys. Steel Const. Fore., S. P., 3745 Linwood Ave., Oakland, Calif. 1918
Singer, E. W., (Ret.), Supvr. B. & B., N. Y. C. & St. L., 6727 3rd Ave. North, St. Petersburg, Fla. 1923
Smith, C. E., (Ret.), Vice Pres., N.Y. N.H. & H., 282 Prospect St., New Haven, Conn. 1911
Swartz, W. G., (Ret.), Eng. Acct., C. N., 1829 SanJuan Ave., R. R. #5, Victoria, B. C., Can. 1917

T

Tattershall, E. R., (Ret.), Supvr. of Mtce. Equip., N.Y.C., 21 Coy St., Malone, N. Y. 1913

W

Wait, R. E., (Ret.), Supv. B. & B., Wabash, 1638 N. Maple, Decatur, Ill. 1923
Walden, W. H., (Ret.), Rdm., Southern, 1012 Porter St., Richmond 24, Va. 1920
White, W. E., (Ret.), Gen. Fore., A.T.&S.F., 706 W. 6th St., Chanute, Kan. 1920
Whitehouse, B. M., (Ret.), Ch. Fire Insp., C. & N. W., 2008 Isabella St., Evanston, Ill. 1927
Winkelhouse, L. C., (Ret.), Asst. Arch. Engr., C. & N. W., 6921 Oriole Ave., Chicago 31, Ill. 1934
Womeldorf, C. F., (Ret.), Div. Engr., C. & N.W., 111 No. 12th St., Norfolk, Nebr. 1917
Wright, C. W., (Ret.), Mast. Carp., L.I., 67 Nassau Pkwy., Oceanside, N. Y. 1908

Z

Zinsmeister, E. C., (Ret.), Mast. Carp., B. & O., 303 - 12th Ave. No., St. Petersburg, Fla. 1905

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Arnold, W. P., Vice Pres. & Gen. Mgr., (Wood Preserving Div.), Koppers Co. Inc. Pittsburgh 19, Pa. . . . 1946

B

Baker, D. L., Vice Pres. & Treas., Baker & Hickey Co., P.O. Box 5008, Tri Village Sta. Columbus 12, Ohio . . . 1946
Bishop, D. B., Dist. Mgr., Dearborn Chemical Co., 2 Gateway Center, Pittsburgh 22, Pa. . . . 1946
Boot, A. K., Sales, Bethlehem Steel Co., Prudential Bldg., Chicago, Ill. . . . 1956
Borcherding, C. H., Sp. Rep., The Master Builders Co., 2125 Maryland Ave., Baltimore, Md. . . . 1947
Boulton, C. R., R. R. Contractor, 10 E. Town St., Columbus 15, Ohio . . . 1946
Brennon, L. D., M. of W. Instr., Air Reduction Sales Co., 620 King Drive, Pine Lake, Ga. . . . 1950
Brietzke, W. F., Mgr. R. R. Mach., Pettibone Mulliken Corp., 4710 W. Division St., Chicago 51, Ill. . . . 1956
Bruce, W. O., Scrap Broker, Luria Bros. & Co., Inc., 2190 Board of Trade Bldg., Chicago, Ill. . . . 1955
Bryant, C. E. Jr., Johns-Manville Sls. Corp., 22 E. 40th St., New York, N. Y. . . . 1951
Bugbee, W. E., Sls. Rep. Railway Equipment, 1802 Alamo National Bldg., San Antonio 5, Texas . . . 1956
Burpee, C. M., Director, American Wood Preservers Institute, 111 W. Washington St., Chicago 2, Ill. . . . 1930
Burres, W. G., Ry. Rep., Portland Cement Association, 33 W. Grand Ave., Chicago 10, Ill. . . . 1956
Buskirk, G. C., Mgr. Ry. Div., Pacific Coast Borax Co., 916 WOW Bldg., Omaha, Nebr. . . . 1949

C

Clapp, K. J., Asst. Sls. Mgr., Homelite Corp., Port Chester, N. Y. . . . 1946
Clark, H., Jr., Mgr. R. R. Sls., Armco Drainage & Metal Products Co., 20 N. Wacker Dr., Chicago, Ill. . . . 1953
Clarke, R., Res. Mgr., Massey Concrete Products Co., 111 W. Washington St. Chicago 2, Ill. . . . 1948
Cross, E. T., Vice Pres., Armco Drainage & Metal Prod. Inc., Middletown, Ohio . . . 1946

D

Davidson, T., Asst. Mgr., Globe Chemical Company, 80 E. Jackson Blvd., Chicago, Ill. . . . 1955
Davis, V. W., Mgr. RR. Sls., Armco Drainage & Metal Pro. Inc., P. O. Box 1343, Atlanta, Ga. . . . 1956
Detzel, G. E., Geo. E. Detzel Co., 2303 Gilbert Ave., Cincinnati, Ohio . . . 1945
Deubel, H. R., Mgr. RR. Div., Chicago Pneumatic Tool Co., 936 E. 87th St., Chicago 19, Ill. . . . 1956
Duffie, F. J., Serv. Eng., Linde Air Prod. Co., 230 N. Michigan Ave., Chicago 1, Ill. . . . 1946

E

Ehni, C. R., Prod. Eng., The Texas Co., 1130 Peronager Rd., Roanoke, Va. . . . 1950
Enstrom, W. A., Mgr. Trk. Mat'ls. Div., Pettibone Mulliken Corp., 4710 W. Division St., Chicago, Ill. . . . 1956
Evinger, F. W., R. R. Rep., The Leon Co., 3243 Euclid Ave., Apt. #2A, Berwyn, Ill. . . . 1946

F

Fechtner, O. R., Div. Prod. Mgr., Pettibone Mulliken Corp., 4710 W. Division St., Chicago 51, Ill. . . . 1956
Filkins, A. J., Pres., Filkins & Son, Co., 9 So. Clinton St., Chicago 6, Ill. . . . 1927

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Fix, F., Dist. Sls. Mgr., Transp. Dept., Johns-Manville Sls. Corp., 1530 Guildhall Bldg., Cleveland, Ohio 1946
Flanagan, L. F., Detroit Graphite Div., Certain-Teed Products Corp., 208 So. LaSalle St., Chicago, Ill. 1937
Fletcher, R. L., Struct. Engr., Timber Engineering Co., 1319 18th St., N. W., Washington, D. C. 1947
Flinn, L. E., Asst. Vice Pres. RR. Div., Dearborn Chemical Co., 375 Merchandise Mart, Chicago 54, Ill. 1949
Frederick, H. Z., Mgr., Ry. Sls. Div., The R. C. Mahon Co., Detroit 34, Mich. 1950

G

Gibboney, J. L., Vice Pres., Nat'l. Aluminate Corp., 422 No. Dover St., La Grange Park, Ill. 1949
Giles, J. M., Spl. Repr., Off-Track Equip., Caterpillar Tractor Co., Peoria 8, Ill. 1938
Glassgold, I. L., Pres., Masonry Resur. & Con. Co., Inc., B. & O. Coal Pier, Baltimore, Md. 1950
Grego, L. A., Sls. Eng. R. R. Div., Pettibone Mulliken Corp., 141 W. Jackson Blvd., Chicago 3, Ill. 1956

H

Harding, C. R., Pres., The Pullman Co., Merchandise Mart Plaza, Chicago, Ill. 1924
Harrison, T. A., Const. Market Specialist, Armco Steel Corp, Middletown, Ohio 1956
Hickey, J. F., Pres., Baker & Hickey Co., P. O. Box 5008, Tri-Village Sta., Columbus 12, Ohio 1946
Hoelzel, W. N., Gen. Mgr. Sls., Gary Screw & Bolt Div., Pittsburgh Screw & Bolt Corp., 122 So. Michigan Ave., Chicago 3, Ill. 1949
Hofer, P., East Dist. Mgr., Pettibone Mulliken Corp., 350 Fifth Ave., New York 1, N. Y. 1956
Hoffman, T. E., Factory Rep., Zone Co., 804 East 17th St., Falls City, Nebr. 1949
Holderman, H. L., Sls. Repr., Bird & Son, Inc., 203 S. West Ave., Elmhurst, Ill. 1951
Holmberg, V. V., Vice Pres., The Ellington Miller Co., 25 E. Jackson Blvd., Chicago 4, Ill. 1942
Holmes, J. L., Salesman, Bird & Son, Inc., 721 Second Ave., West Haven, Conn. 1956
Holstein, F. W., Vice Pres., The Rails Co., 115 Observer Highway, Hoboken, N. J. 1948
Hopkins, W. S., Jr., M. of W. Repr., Air Reduction Sales Co., 409 S. Harrison St., Garrett, Ind. 1949

I

Itter, R. C., Sls. Corresp., Pettibone Mulliken Corp., 4710 W. Division St., Chicago 51, Ill. 1957

J

Jacobson, A. E., Serv. Eng., Linde Air Prod. Co., 230 N. Michigan Ave., Chicago, Ill. 1950
Johnson, I. K., 3958 N. 54th St., Milwaukee, Wis. 1953
Jones, J. A., Sls. Eng., West Coast Engine & Equip. Co., 1077 East Shore, Berkeley, Calif. 1956

K

Kalinka, J. E., Pres., Roberts & Schaefer Co., 130 N. Wells St., Chicago 6, Ill. 1946
Kellogg, J., RR. Sls. Rep., National Lead Co., 111 Broadway, New York 6, N. Y. 1956
Kiester, R. S., Slsman., Pacific Coast Borax Co., 503 Southern Standard Bldg., Houston 2, Tex. 1950

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Lacey, J. W., Rep. R. R. Dept., Linde Air Products Co., 230 N. Michigan Ave., Chicago 1, Ill. . . . 1946
LeDuc, C. L., Sls. Rep., Republic Powdered Metals, Suite 1310, 109 N. Wabash Ave., Chicago 2, Ill. . . . 1946
Lipscomb, W. P., Mgr. RR. Sls., Armco Drainage & Metal Prod., Inc., P. O. Box 1699, Houston, Texas . . . 1956
Lockart, E. P., Sls. Mgr., Insulux Glass Block Div., Kimble Glass Co., P. O. Box 1035-36, Toledo, Ohio . . . 1951
Loeffler, J. S., R. R. Sales Mgr., Armco Drainage & Metal Prod., Inc., 43435 Lyndale Ave. No., Minneapolis, Minn. . . . 1955
Luther, L. A., Serv. Engr., Ingersoll Rand Co., 1121 Hamilton Ave., Palo Alto Calif. . . . 1945
Lynch, J. K., Res. Mgr., Massey Concrete Prod. Co., Rm. 407-408, Brown Marx Bldg., Birmingham 3, Ala. . . .
Lyon, C. A., Reg. Mgr., Master Builders Co., Rm. 412-414 Michigan Bldg., Detroit 26, Mich. . . . 1945

Mc

McDaniel, W. L., Vice Pres., Massey Concrete Prod. Co., 111 W. Washington St., Chicago 2, Ill. . . . 1945
McMahon, R. D., Sales Engr., Fabreeka Prod. Co., 325 W. Huron St., Chicago, Ill. . . . 1955

M

Mabry, D. B., Mgr. Lmbr. Sls., T. J. Moss Tie Co., 700 Security Bldg., St. Louis, Mo. . . . 1948
Mann, E. A., Pres., Champion Transportation Sls., Inc., 222 W. Adams St., Chicago 6, Ill. . . . 1951
Maurer, S. S., Western Div. Mgr., Fabreeka Prod. Co., 325 W. Huron St., Chicago 10, Ill. . . . 1952
Mayfield, P. B., Tech. Cons., Barrett Div., Allied Chem. & Dye Corp., 40 Rector St., New York 6, N. Y. . . . 1950
Myers, D. R., Sls. Repr., R. R. Sls., Patterson Sargent Co., 1882 S. Normal Ave., Chicago 16, Ill. . . . 1952

N

Needham, L. H., Pres., The Penetryn System, Inc., 2294 Scranton Rd., Cleveland Ohio . . . 1946
Nuckols, L. T., Conslt. Eng., 3316 Gloucester Rd., Richmond 27, Va. . . . 1951

P

Parke, J. R., Salesman, Pacific Coast Borax Co., Wilford Bldg., 33rd & Arch St., Philadelphia, Pa. . . . 1956
Patterson, R., Gen. Mgr., Intrusion Prepakt, Inc., 779 Union Commerce Bldg., Cleveland 14, Ohio . . . 1946
Patton, R. C., Tech. Adviser, Libby Zone Co., 731 E. Kingston Ave., Charlotte, N. C. . . . 1952
Phillips, R. O., Asst. to Pres., The Zone Co., Fireplate Div., P. O. Box 789, Fort Worth, Texas . . . 1956

R

Richter, R. W., Sales Engr., Armco Drainage & Metal Prod., Inc., 20 N. Wacker Drive, Chicago 6, Ill. . . . 1953
Rieser, D. A., Ch. Eng., T. W. Snow Const. Co., 10 West Wilson St., Batavia, Ill. . . . 1956
Ruhl, D. A., R. R. Engr., Ordnance Corps, U. S. Army, Joliet, Ill. . . . 1948

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Schneider, C. A., Pres., Schneider Const. Co., Inc., 3004 W. Dallas Ave., Houston, Texas 1956
Scott, J. M., Sls., The Arco Co., 614 Delaware St., Scranton 9, Pa. 1945
Seyler, A. P., Indus. & R. R. Sls. Div., Master Builders Co., 7016 Euclid Ave., Cleveland 3, Ohio 1954
Smith, F. C., R. R. Dept., Marsh & McLennan, Inc., 231 S. LaSalle St. Chicago 4, Ill. . . 1948
Smith, W. T., Gen. Supt., Geo. E. Detzel Co., 2303 Gilbert Ave., Cincinnati, Ohio 1950
Southwick, C. E., 114 Halstead Circle, Alhambra, Calif. 1945
Stierer, G. W., Mgr. Struct'l. Steel Dept., Robt. W. Hunt. Co., 175 W. Jackson Blvd., Chicago 4, Ill. 1946
Sullivan, J. W., Asst. Sales Mgr., Wood Pres. Div., Koppers Co. Inc., 700 Koppers Bldg., Pittsburgh, Pa. 1955
Swallow, O., Pres., Utilities Div., The Zone Co., P. O. Box 789, Ft. Worth, Texas 1956

T

Thompson, N., Vice Pres., Homelite Corp., Port Chester, N. Y. 1946
Thoresen, H. B., Sales, Globe Chemical Co., 80 E. Jackson Blvd., Chicago, Ill. 1955
Truss, F. W., Mgr., RR. Sales, Armco Drainage & Metal Prod. Inc., 10 S. Brentwood Blvd., Clayton 5, Mo. 1946
Twomey, J. F., Vice Pres., McCracken Contracting Co., 7340 S. Western Ave., Chicago, Ill. 1956

U

Utley, O. H., Vice Pres., The Zone Co. A Div. - Southwestern Pet. Co., 917 N. Main St., Ft. Worth, Texas 1949

V

Van Wolf, A. F., Gen. Mgr., General Concrete Restoration Corp., 330 S. Dearborn St., Chicago, Ill. 1955
Von Kampen, K., Ch. Eng., Pettibone Mulliken Corp., 4710 W. Division St., Chicago 51, Ill. 1956

W

Walters, W. R., 1535 Rand Tower, Minneapolis, Minn. 1949
Weiss, W. E., Sls. Eng., Pettibone Mulliken Corp., 4710 W. Division St., Chicago 51, Ill. 1956
Wicker, W. S., Ch. Engr., Transportation Mutual Insurance Co., 150-10th Street, N.E., Atlanta 5, Ga. 1953
Williams, C. B., Pres., Ever Tight Bolt Assembly Co., 238 Lincoln Ave., Council Bluffs, Ia. 1954
Williams, G. S., Supt., Southern Amiesite Asphalt Co., Inc., 3401 5th Ave. No., Birmingham, Ala. 1956
Wilson, W. C., Sls. Engr., Ralph W. Payne Co., Nat'l. Met. Bk. Bldg., Washington D. C. 1951
Wingerson, C., Ry. Sls. Engr., Oliver Iron & Steel Corp., 1001 Muriel St., Pittsburgh 3, Pa. 1954

Y

Young, R. W., R. W. Young Mfg. Co., 35 E. Elm St., Chicago 11, Ill. 1946

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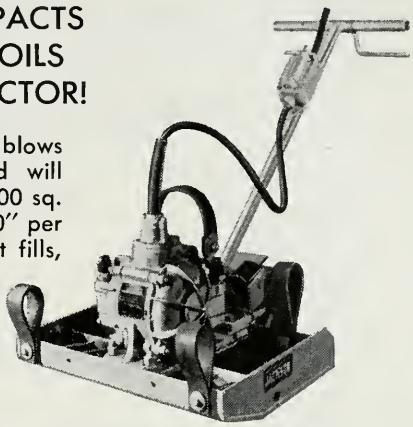

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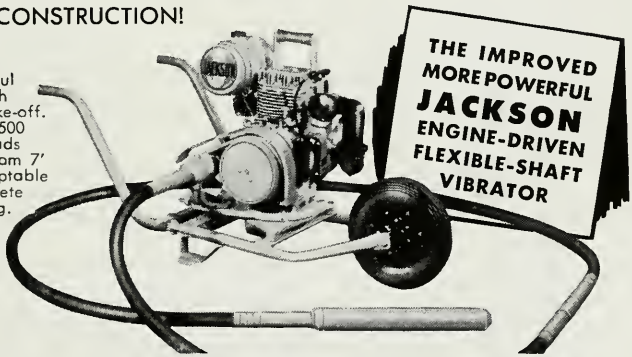

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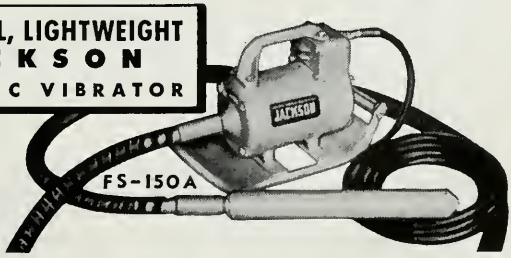

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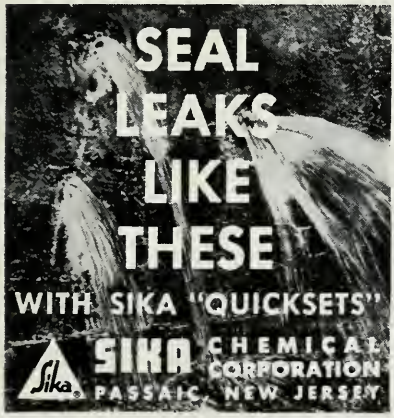

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No.	Place of Meeting	Date	Membership
1	St. Louis, Mo.	Sept. 25, 1891	60
2	Cincinnati, Ohio	Oct. 18-19, 1892	112
3	Philadelphia, Pa.	Oct. 17-19, 1893	128
4	Kansas City, Mo.	Oct. 16-18, 1894	115
5	New Orleans, La.	Oct. 15-16, 1895	122
6	Chicago, Ill.	Oct. 20-22, 1896	140
7	Denver, Colo.	Oct. 19-21, 1897	127
8	Richmond, Va.	Oct. 18-19, 1898	148
9	Detroit, Mich.	Oct. 17-19, 1899	148
10	St. Louis, Mo.	Oct. 16-18, 1900	143
11	Atlanta, Ga.	Oct. 15-17, 1901	171
12	Minneapolis, Minn.	Oct. 21-23, 1902	195
13	Quebec, Canada	Oct. 20-22, 1903	223
14	Chicago, Ill.	Oct. 18-20, 1904	293
15	Pittsburgh, Pa.	Oct. 17-19, 1905	313
16	Boston, Mass.	Oct. 16-18, 1906	340
17	Milwaukee, Wis.	Oct. 15-17, 1907	341
18	Washington, D. C.	Oct. 20-22, 1908	368
19	Jacksonville, Fla.	Oct. 19-21, 1909	393
20	Denver, Colo.	Oct. 18-20, 1910	428
21	St. Louis, Mo.	Oct. 17-19, 1911	499
22	Baltimore, Md.	Oct. 15-17, 1912	524
23	Montreal, Quebec	Oct. 21-23, 1913	570
24	Los Angeles, Cal.	Oct. 20-22, 1914	586
25	Detroit, Mich.	Oct. 19-21, 1915	665
26	New Orleans, La.	Oct. 17-19, 1916	710
27	Chicago, Ill.	Oct. 16-18, 1917	704
28	Chicago, Ill.	Oct. 15-17, 1918	716
29	Cleveland, Ohio	Oct. 21-23, 1919	776
30	Atlanta, Ga.	Oct. 26-28, 1920	840
31	New York, N.Y.	Oct. 18-20, 1921	850
32	Cincinnati, Ohio	Oct. 17-19, 1922	865
33	Seattle, Wash.	Oct. 16-18, 1923	846
34	Kansas City, Mo.	Oct. 21-23, 1924	837
35	Buffalo, N.Y.	Oct. 20-22, 1925	759
36	Richmond, Va.	Oct. 12-14, 1926	750
37	Minneapolis, Minn.	Oct. 18-20, 1927	754
38	Boston, Mass.	Oct. 23-25, 1928	755
39	New Orleans, La.	Oct. 15-17, 1929	755
40	Louisville, Ky.	Oct. 21-23, 1930	713
41	Chicago, Ill.	Oct. 16-18, 1934	592
42	Chicago, Ill.	Oct. 15-17, 1935	547
43	Chicago, Ill.	Oct. 20-22, 1936	588
44	Chicago, Ill.	Oct. 19-21, 1937	566
45	Chicago, Ill.	Oct. 18-20, 1938	589
46	Chicago, Ill.	Oct. 17-19, 1939	546
47	Chicago, Ill.	Oct. 15-17, 1940	610
48	Chicago, Ill.	Oct. 14-16, 1941	594
49	Chicago, Ill.	Oct. 20-22, 1942	618
50	Chicago, Ill.	Oct. 20-21, 1943	597
51	Chicago, Ill.	Sept. 17-19, 1946	698
52	Chicago, Ill.	Sept. 16-18, 1947	651
53	Chicago, Ill.	Sept. 20-22, 1948	652
54	Chicago, Ill.	Sept. 12-14, 1949	676
55	Chicago, Ill.	Sept. 18-20, 1950	713
56	Chicago, Ill.	Sept. 17-19, 1951	676
57	Chicago, Ill.	Sept. 15-17, 1952	667
58	Chicago, Ill.	Sept. 15-17, 1953	666
59	Chicago, Ill.	Sept. 13-15, 1954	682
60	Chicago, Ill.	Sept. 19-21, 1955	625
61	Chicago, Ill.	Sept. 18-20, 1956	657

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